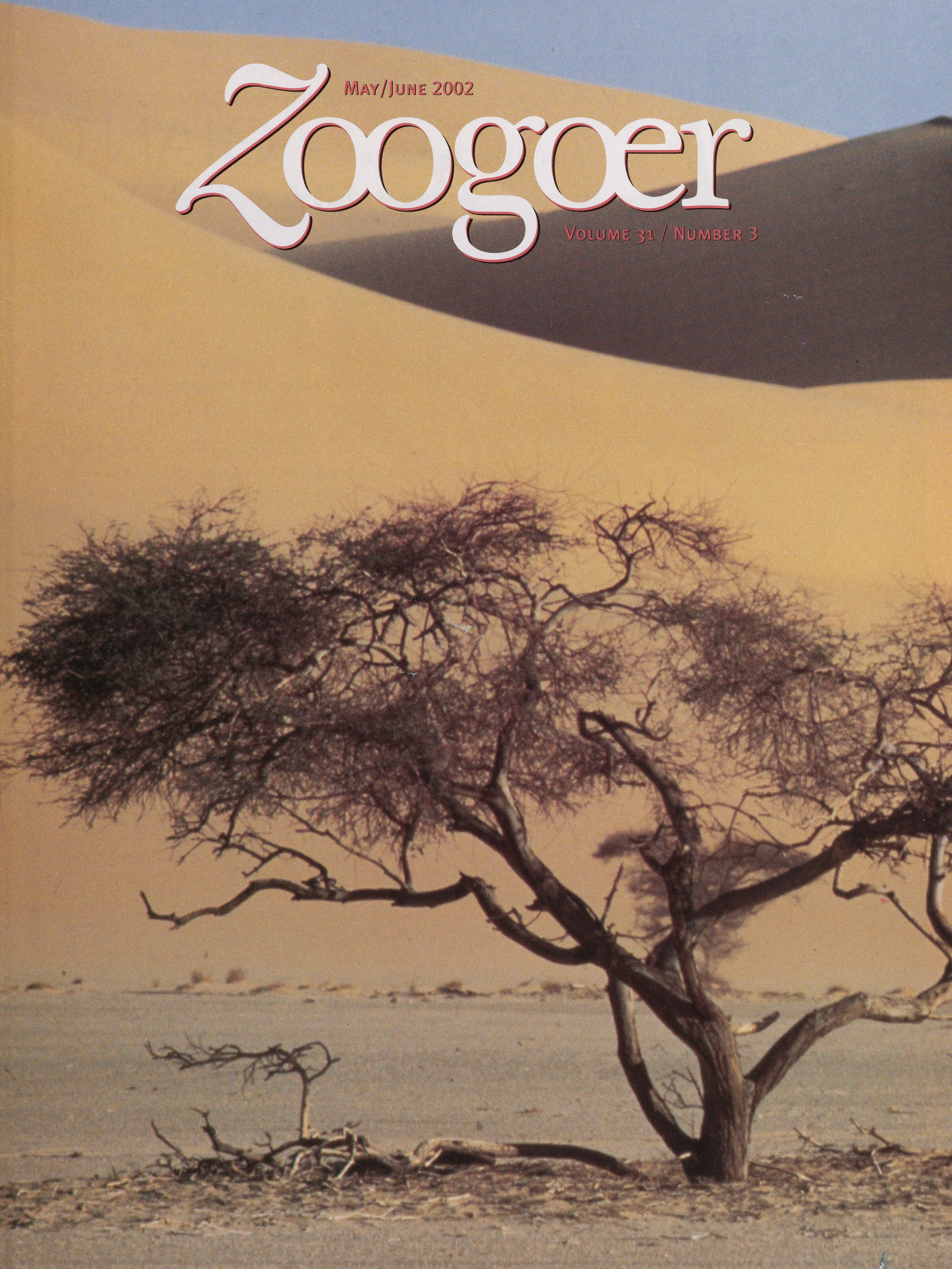
May/June 2002

Zoogoer

Volume 31 / Number 3



SMITHSONIAN BOOK OF

GIANT PANDAS

Susan Lumpkin & John Seidensticker
Foreword by Lucy H. Spelman

The arrival of the two giant pandas Tian Tian and Mei Xiang at the Smithsonian's National Zoo has created an enormous outpouring of public support for the conservation of this endangered species. The first step in attempting to ensure a future for giant pandas is understanding both their history and their current relationship with people. Susan Lumpkin and John Seidensticker present a beautifully photographed, resonant natural history, sharing their personal experiences of working with giant pandas in the United States and China.

The authors begin by examining the intertwined relationship between giant pandas and people, exploring how these striking animals became icons of goodwill between nations. Looking further back in time, the authors examine the fossil record to trace the evolution of giant pandas, explaining how their strict diet of bamboo has shaped their past and will continue to shape their future in the wild. The rim of the Sichuan Basin in central China—home of the giant panda—is a wonder of biodiversity; a sampling of the region's animals and plants is followed by a history of the environmental changes caused by humans.

The Smithsonian has made a monumental commitment to conserving giant pandas, and the authors close the book by recounting their journey to China in May 2001, when they visited panda reserves to help determine the best use for the Zoo's resources and $10 million in financial support. They found that a bright future for giant pandas is possible, but much remains to be done.

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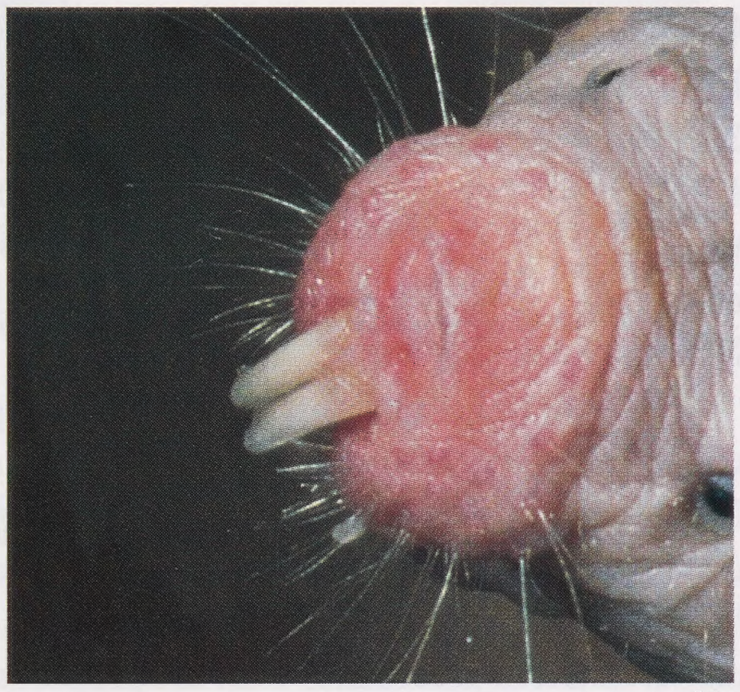
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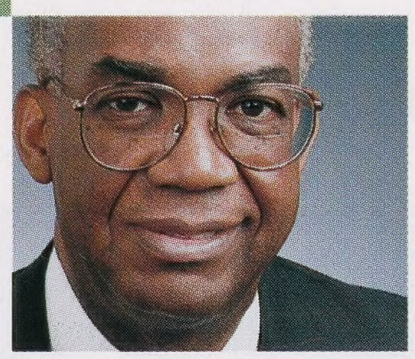

CALL TO NOMINATIONS

In accordance with our Bylaws, the Friends of the National Zoo Board of Directors is now soliciting nominations from the membership. Our volunteer Board plays an essential role in FONZ leadership and operation, and we rely on our members to recommend people with appropriate skills and talents to assist our efforts to support the Smithsonian's National Zoological Park.

I ask you to help by nominating to the Board persons who are interested in this very special community service. You may also nominate yourself. Nominations will be reviewed by the Board's Nominating Committee. The names of selected candidates will be forwarded to the membership for election. The criteria by which potential candidates are judged for nomination to the Board of Directors include: the candidate's strong interest in supporting zoological education, research, and conservation in accordance with the purposes of our corporation; leadership; experience or skills that are needed and that would directly benefit FONZ management and operations; and the willingness to commit significant amounts of time to participate fully in FONZ work and activities. Candidates must be dues-paying members of FONZ.

Much of the Board's work is accomplished through committees. For example: The Education and Technology Committee makes policies and provides guidance for FONZ-supported education, conservation, outreach, and Zoo-supported programs. The Membership and Development Committee develops policies related to membership activities and provides oversight for membership acquisition and retention programs and fundraising for the Zoo. The Guest Services/Concessions Committee formulates policies for FONZ concessions operations and visitor support services. Other Board committees include: Administration, Finance and Audit, and Nominating.

All Board members are expected to serve on at least two committees and may be asked to attend one or more meetings or functions each month. Nominations may be made only by dues-paying members and must be submitted on an official FONZ Nomination Form with a biographical sketch of the nominee. Call 202.673.4951 to receive Nomination Forms or to discuss Board services with me or a member of the Board. The deadline for submitting nominations is July 19, 2002.

Sincerely,

Clinton A. Fields
Executive Director

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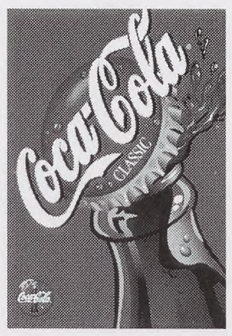

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Membership in FONZ offers many benefits: publications, discounts on shopping, programs, and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, Washington, DC 20008, call 202.673.4961 or go to www.fonz.org.

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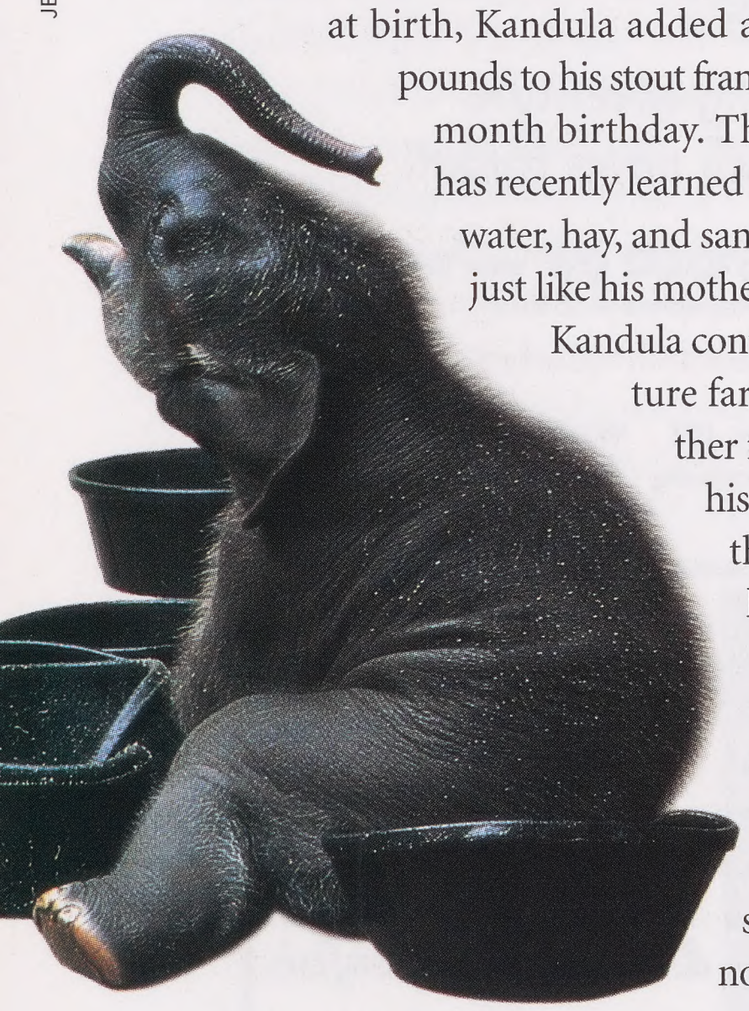
ANIMAL NEWS



JESSIE COHEN/NZP

Asian elephant (*Elephas maximus*) Kandula is gaining weight and going strong at the National Zoo's Elephant House. Weighing 325 pounds at birth, Kandula added a healthy 190 pounds to his stout frame by his four-month birthday. The young calf has recently learned how to throw water, hay, and sand on his back just like his mother, Shanthi. As Kandula continues to venture farther and farther from mom in his daily activity, the elephant keepers are teaching him the do's and don'ts of interacting with Zoo staff. Right now he is learning mostly the don'ts: don't push, don't shove, don't run into, don't rub against, don't lean on, don't kick. These are normal baby elephant behaviors that other elephants can withstand, but his human playmates are a little more frail!

The joy over Kandula was replaced with sorrow, however, when Ryma, the Zoo's 17-year-old male Masai giraffe (*Giraffa camelopardalis tippelskirchi*), died at the Elephant House Saturday, February 9. Ryma had been under treatment for chronic hoof problems and arthritis for more than a year. When Zoo keepers arrived early in the morning of February 9, they found Ryma resting in a sitting position, unable to rise from the floor of his enclosure. Despite six hours of intensive medical treatment, Ryma became very weak and died that afternoon. Zoo Director Lucy Spelman, who was at the giraffe's side all day, said, "Ryma was a great animal. He lived a long life and was well loved by Zoo visitors and his keepers. We are lucky to have his daughter, Jana, here at the Zoo." Ryma's mate, Griff, gave birth to Jana on January 18, 2001. Both mother and daughter remain healthy and active in their Elephant House exhibit.

JESSIE COHEN/NZP

Another youngster, Sumatran tiger Berani, can now be seen outdoors at the Great Cats exhibit for several hours each day. Adapted to the tropical heat of Indonesia, the tiger cub spent his first cold winter in Washington, D.C., inside. In the wild, a tiger (*Panthera tigris*) begins traveling alongside its mother and feeding from her kills at about two months of age. Scientists have observed cubs become adept hunters as early as 11 months after birth. Tiger cubs live with their mothers for two to three years before striking out to establish their own territories. Call 202.673.4717 for the current times to see Berani outside.

SUMMER SOIREES

Flush from the success of our annual spring fundraisers, Guppy Gala and ZooFari, FONZ is charging ahead with plans for an eventful summer. Our annual **ZooNight** will take place on June 15 from 5:30 to 8:30 p.m. The event will give members the opportunity to stroll through the Zoo after the crowds have gone, enjoying food, fellow FONZ folks, and plenty of fun activities.

The first in this year's series of Young Professionals (YP) "After Hours" events, **"Who Let the Prairie Dogs Out?,"** kicks off the YP season on June 20 from 6 to 9 p.m. Partygoers will enjoy dance-mix music, appetizers, and a cash bar. Admission is $8 prepaid for FONZ YP members; $10 at the door. Sign up for YP membership and get two free tickets to any single "After Hours" event. For more information about the event or about FONZ's YP program, call 202.673.4953 or log onto www.fonz.org/getinv/yp.htm.

From June 27 to August 1, FONZ will host a series of free concerts, **Sunset Serenades**, delivering great musical entertainment on Lion/Tiger Hill each Thursday evening from 6:30 to 8 p.m. Call 202.673.4989 or log onto www.fonz.org/events/sunset_serenades.htm for the latest schedule of performers.

SPRUCE UP THE ZOO

The Zoo's Bird House is seeking donations of plants and small trees that require low-light levels, such as cast iron plants (*Aspidistra elatior*), Chinese evergreens (*Aglaonema modestum*), bird's nest ferns (*Asplenium nidus*) or other ferns, spider plants (*Chlorophytum comosum*), and Norfolk Island pines (*Araucaria heterophylla*). Artificial plants or trees are also welcome. Donations can be dropped off at the Zoo Greenhouse with a note saying they are intended for the Bird House. If you have any questions, please contact Nancy Levan at 202.673.4669 or levann@nzp.si.edu.

Letter from the Director

Dear ZooGoer,

This is my first in a regular series of letters to all zoogoers.

I wish to thank FONZ Executive Director, Clinton Fields, and *ZooGoer* editor, Susan Lumpkin, for the opportunity to communicate directly with all of you through the magazine.

With this first letter, I would like to emphasize the importance of partnerships and teamwork. Many have said—and I agree—that the future of conservation is collaboration. We must work together, both inside and outside of the Zoo, to build teams and partnerships that will ultimately support the diversity of life on Earth.

The relationship between the Smithsonian's National Zoo and Friends of the National Zoo is an excellent example. We are partners in our efforts to support the mission of the Zoo: to study, celebrate, and help protect animals and the diversity of their habitat.

This partnership is essential if we are to fulfill our vision for the National Zoo: to broaden our public outreach programs, modernize our oldest exhibit areas, and renew our role as a leading center for zoo animal care, reproductive biology, and conservation research.

Finally, it will require a team effort on the part of Zoo and FONZ staff, as well as Smithsonian staff, members of the FONZ Board, the CRC Foundation Board, the Zoo Advisory Board, and the Smithsonian National Board to accomplish our plan for the future: to renovate the oldest areas of the Zoo to create modern exhibits designed to bring our visitors closer to our animals, to our research programs, and to our conservation projects worldwide. Through our exhibits, we hope to inspire our visitors to develop stronger bonds with animals. In turn, we hope to motivate Zoo visitors to help protect nature.

We really are one big team made up of many smaller teams. Each of these smaller teams is focused on a different area: special events, website design, Zoo renovations, education programs, scientific research, community outreach, fundraising, and more. The members of these teams include experts from all of the organizations listed above. Each team has a leader whose role is to keep the members focused on the job at hand, and to support the effort via public or private funding. Although it can be challenging to work on a team—each member has his or her own skills and opinions—it is ultimately more rewarding.

As Zoo Director, my job is to serve as the overall team leader and help keep the focus on the big picture: the mission, vision, and plan for the future. In addition, my job is to secure the resources, both federal and non-federal, so that each of the smaller teams can move forward and accomplish its goals. Again, this will require a team effort.

I believe we are well on our way. The future is challenging, but it is also exciting. Enjoy the Zoo this spring and summer—it will be beautiful as always. I thank you for your support in the past and look forward to our continued partnerships in the future.

Sincerely,

Lucy Spelman
Director
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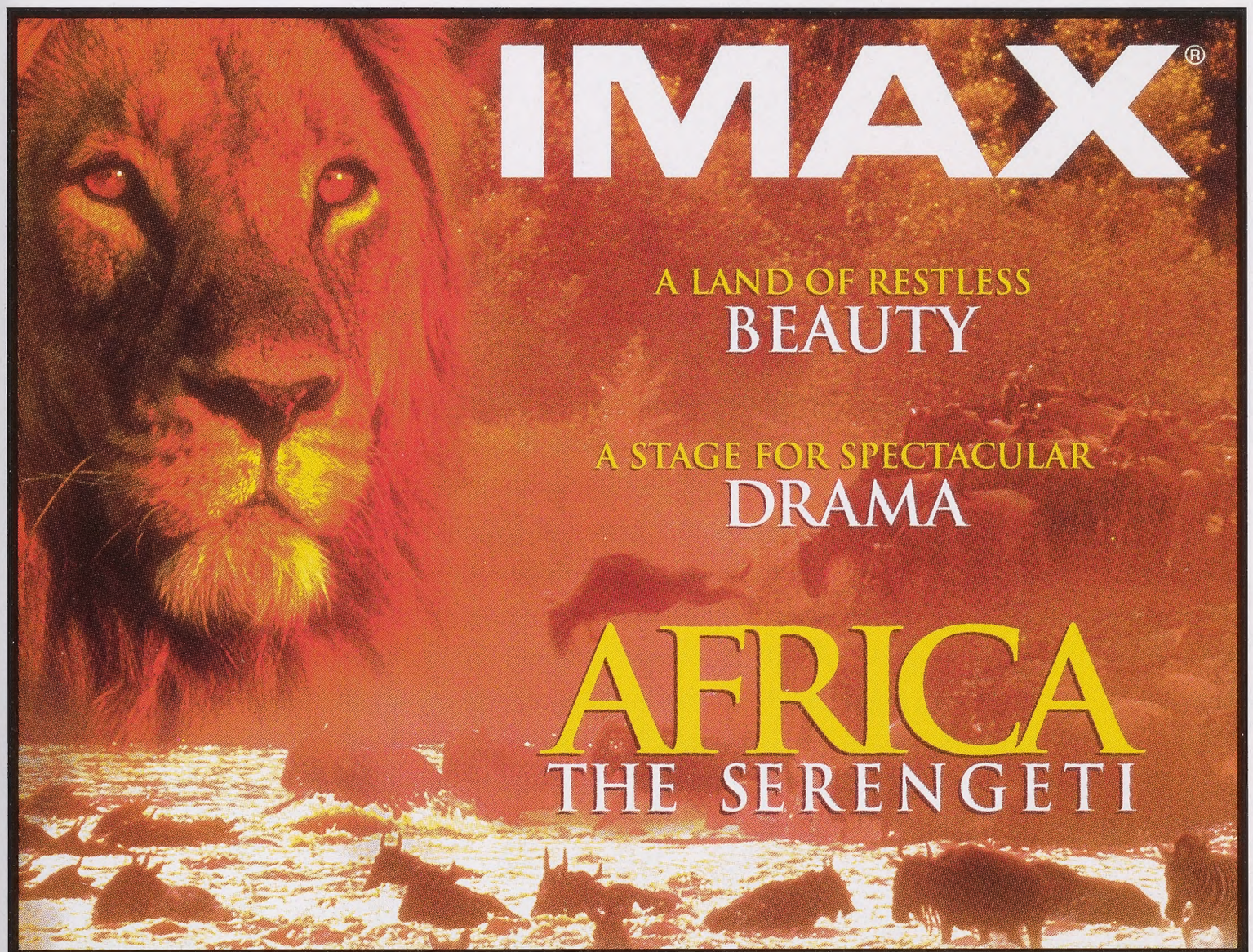

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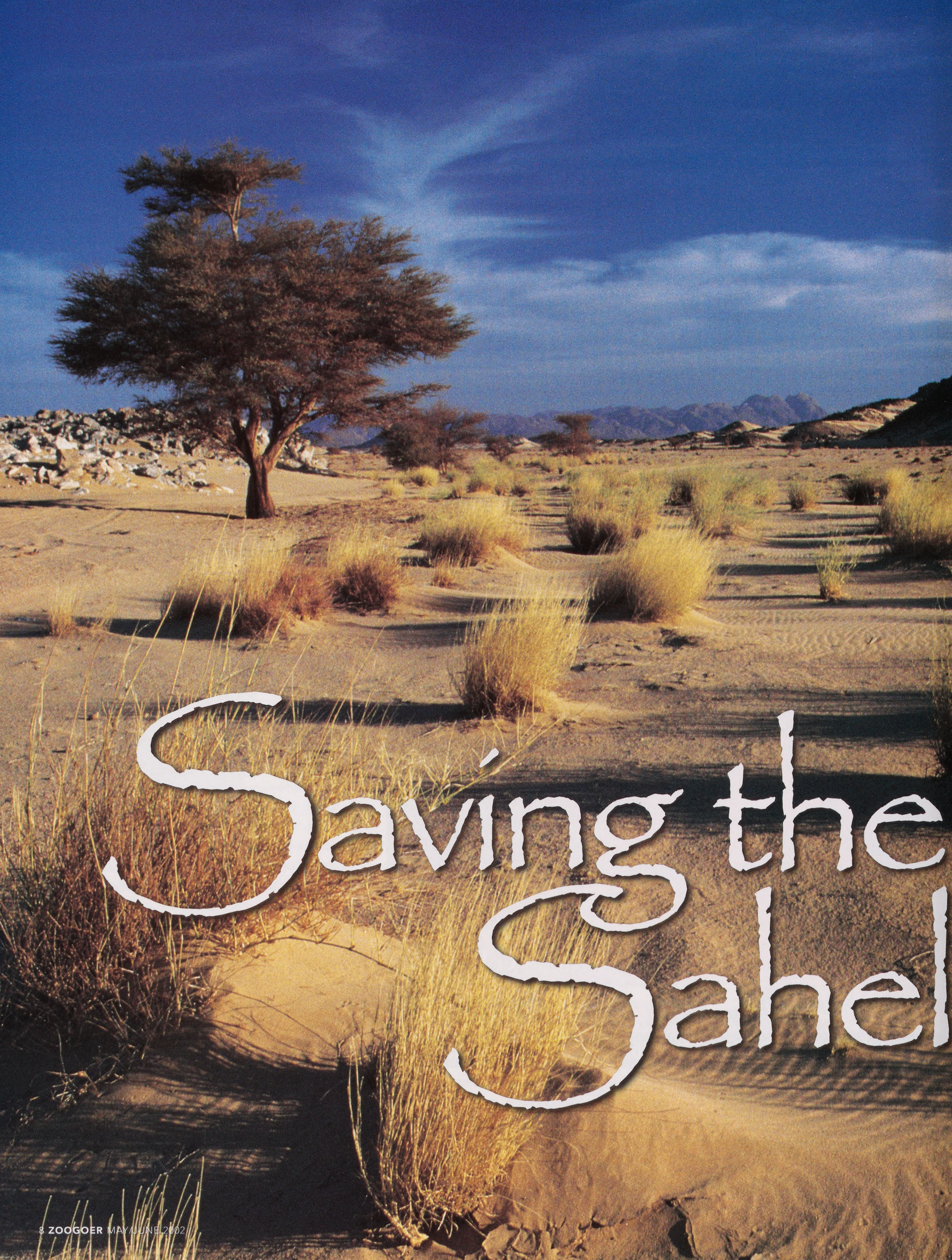


Saving the Sahel

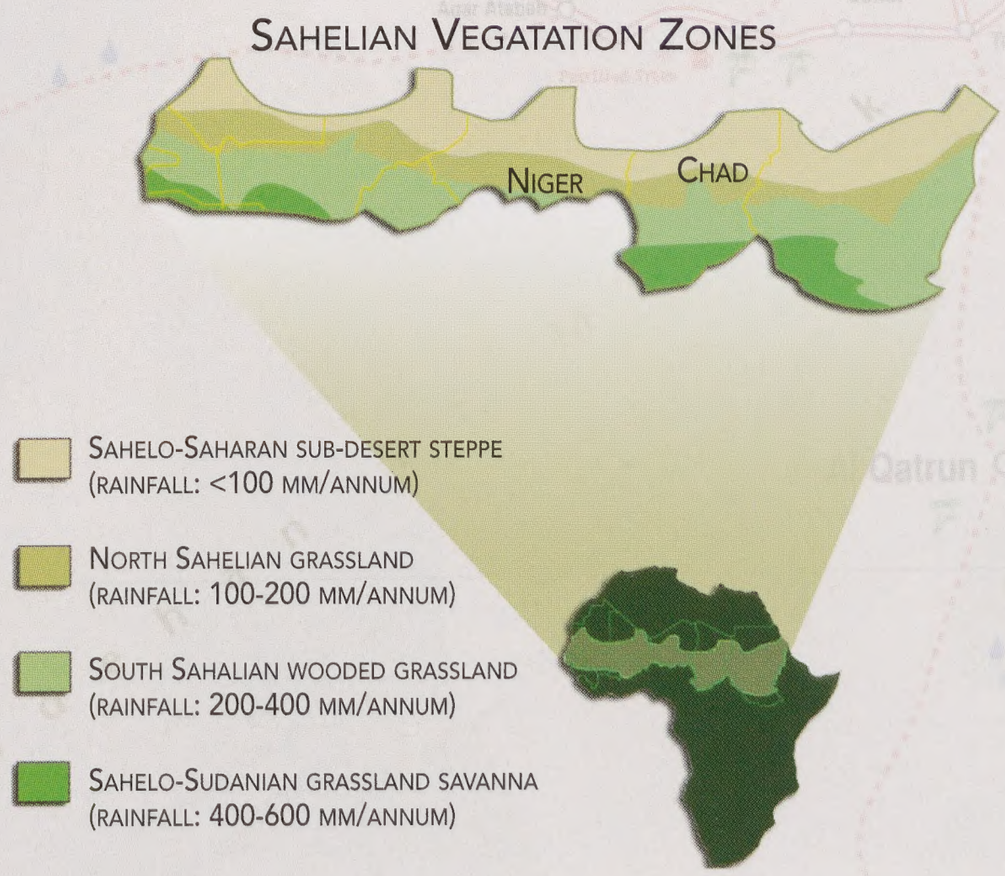
A SANDY WADI STRETCHES TOWARD THE AÏR MOUNTAINS, NIGER, SUPPORTING ACACIA TREES (*ACACIA RADDIANA*) AND PERENNIAL TUSSOCK GRASSES (*PANICUM* SP., *LASIURUS* SP.).

BY HOWARD YOUTH

On a map, the ecological zones of the Sahel appear to stack up like the layers of a cake, according to ecologist John Newby. In this case, he's describing the desert, not dessert. A senior advisor for the species program at the Switzerland-based World Wide Fund for Nature (WWF International), Newby speaks lovingly and knowledgeably about the Sahara's southern boundary, the Sahel. He lived there in the 1970s and fell in love with its varied fauna, including endangered antelope that Newby and his colleagues hope to help restore to some semblance of their former abundance.

PHOTOS BY
JOHN NEWBY

SAHELIAN VEGATATION ZONES



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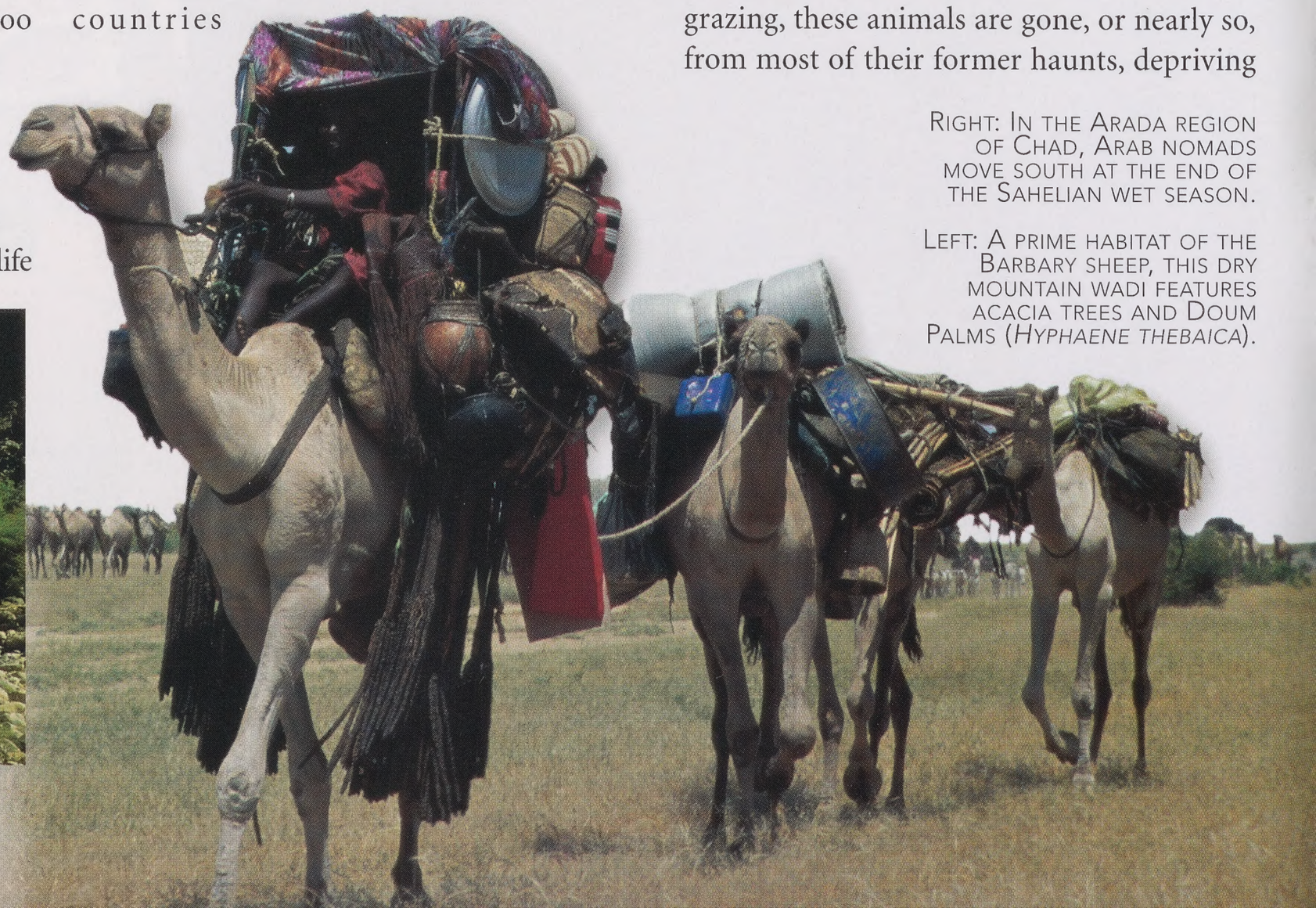
A Bororo (Peul) nomad from the Agadez region, Niger, wears a face-pack made from millet meal to protect his skin from the sun.

Wary dorcas gazelles in the Ténéré desert, Niger.

In Arabic, the word Sahel refers to the "shore" of the sea of sand, but the transition from grassland to desert is more varied than you might imagine. "The characteristic soil types, vegetation, and climatic zones are in north-to-south-running layers," Newby explains. Moving north, rainfall decreases, and acacia-studded savanna fades gradually to tussocky grassland. Spotty vegetation patches then yield to a stark, gargantuan span of mountains, rocks, and sand—the mighty Sahara.

Although the stacked habitat layers vary in thickness, they are generally thin but very wide. The Sahel spans from Atlantic-hugging Senegal east to Egypt's Nile Valley, a distance roughly equal in width to the United States. Yet aside from its inhabitants—mostly nomads, livestock herders, and subsistence farmers—and foreign hunters, few pay any attention to this fragile region, something Newby, Smithsonian's National Zoo veterinarian Steve Monfort, Zoological Society of London wildlife biologist Tim Wacher, and others hope to change.

In September 2001, Newby, Monfort, Wacher, and seven others spent three weeks traversing Chad's dusty frontier, seeking wildlife in places where surveys had not taken place in 20 years. Their trip was funded by the Smithsonian Institution, WWF International, the Zoological Society of London, the Scientific Council of the Convention on Migratory Species (or Bonn Convention), and several North American zoos. Under the Convention on Migratory Species, 14 Sahelo-Saharan countries seek to protect and, where necessary, reintroduce six endemic antelope species: dorcas gazelles (*Gazella dorcas*), dama gazelles (*Gazella dama*), slender-horned gazelles (*Gazella leptoceros*), Cuvier's gazelles (*Gazella cuvieri*), addax (*Addax nasomaculatus*), and scimitar-horned oryx (*Oryx dammah*). Long over-hunted, plagued by drought, and pinched by excessive livestock grazing, these animals are gone, or nearly so, from most of their former haunts, depriving



Right: In the Arada region of Chad, Arab nomads move south at the end of the Sahelian wet season.

Left: A prime habitat of the Barbary sheep, this dry mountain wadi features acacia trees and Doum Palms (*Hyphaene thebaica*).

A TWAREG GIRL STANDS IN AN IRRIGATED FIELD OF NATIVE WHEAT IN NIGER.

TYPICAL SAHELIAN WOODED GRASSLANDS DURING THE BRIEF WET SEASON THAT LASTS FROM JUNE TO SEPTEMBER. THESE GRASSLANDS WERE ONCE THE HOME TO THE SCIMITAR-HORNED ORYX AND THE DAMA GAZELLE.

ecosystems of their vital natural services. For instance, browsers like dorcas and dama gazelles are especially effective seed-spreaders. "Following rain, one can find whole nurseries of young acacias growing where gazelles have spread their dung in shady areas," says Newby. Supremely suited to their habitat, arid-land antelope, unlike livestock, can survive for months and even years without drinking water, stripping moisture from the plants they eat in their sparsely vegetated habitats.

Chad and Niger hold some of the most promising remaining habitats, which is why the team set their sights on surveying Chad first, to be followed later this year by Niger. They hoped to get a fix on the status of the remaining antelope and other wildlife, and figure out the potential for conservation programs there. Only recently has Chad emerged from almost three decades dominated by civil war, unrest, periods of deadly drought, and war with Libya. Last year, Monfort, Newby, and Wacher traversed 2,100 roadless miles—roughly the distance from Washington, D.C., to Salt Lake City, Utah—in three Toyota Land Cruisers. They were joined by two other biologists, including Djadou, a Chadian wildlife official, two Chadian drivers, a Chadian cook, and two Italian outfitters.

Traveling eight hours a day in temperatures that at times exceeded 115° F, they surveyed wildlife, animal tracks, habitat quality, livestock, people, and other landscape components—usually while on the move. In the evenings, they plotted many of these features using Global Positioning System devices. Their careful mapping and plotting of geographic coordinates will enable scientists to track future changes. Thanks in good part to Newby's fluent Arabic, the team also interviewed locals to try to locate rare animals. What they found was surprising.

First, in many places the Sahel vegetation was the lushest Newby had ever seen. "We'd drive through vast stretches where there was nothing, then—boom—the habitat would change. It just depends where rainfall was or wasn't." The growth of grasses, trees, and shrubs will sustain wildlife large and small for the next decade. Other areas, missed by the recent rain, seemed listless and

ALL EARS, THE FENNEC FOX IS THE MOST COMMON SMALL PREDATOR OVER MUCH OF THE SAHARA DESERT.

At the Ouadi Rimé-Ouadi Achim Game Reserve, Chad, a game guard shows a scimitar-horned-oryx trophy recovered from poachers.

From top to bottom: Hardy tussock grasses make for addax prime habitat.

A Twareg farmer prepares to sow irrigated cereals, such as wheat or corn.

Barbary sheep herd in typical mountain habitat.

Golden jackal.

Nubian bustard.

barren. "The desert comes to life with water, that's for sure," says Monfort.

Despite exceptional rainfall that left large areas of lush forage, the team could not locate species that were once abundant in the area. "It was like the 'Empty Forest Syndrome,' where equatorial rainforests look fabulous, but the wildlife is not there because it's been hunted out," says Monfort. Thanks to tips provided by local nomads, the team did spot 15 dama gazelles, the world's largest gazelle species. These elegant white and reddish desert antelopes are extremely skittish. Most were found in only one small area. "We were surprised that they were so confined," says Monfort, "and it confirmed that these animals are under pressure and in danger of extinction there."

"IT WAS LIKE THE 'EMPTY FOREST SYNDROME,' WHERE EQUATORIAL RAINFORESTS LOOK FABULOUS, BUT THE WILDLIFE IS NOT THERE BECAUSE IT'S BEEN HUNTED OUT," SAYS MONFORT.

Following nomads' advice, the team was lucky enough to find a pair of desert phantoms. On the heat-shimmered horizon, they spotted two distant—and very wary—addax. Perhaps a few hundred of these corkscrew-horned antelopes survive in the wild in remote pockets of the Sahel and Sahara. Among antelopes, this species is best adapted to desert, wandering widely in response to infrequent rains. Their hardiness usually puts them beyond reach of grazing livestock and hunters and is perhaps the reason they've yet to follow the fate of one enigmatic creature that the team could not find: the scimitar-horned oryx.

"Interviews with nomads revealed no sightings of oryx in 20 years," said Monfort sadly. Once hundreds of thousands of scimitar-horned oryx inhabited the Sahel, frequenting lush areas that are also popular with hunters and livestock herders. The white and rust-orange desert wanderers are now believed to be extinct in the wild. Sustained drought likely dealt the final blow.

Despite tireless searching, the team could not locate other once-characteristic creatures. Cheetahs (*Acinonyx jubatus*) did not show, and members of the region's endemic red-necked ostrich subspecies (*Struthio camelus camelus*) were nowhere to be seen either. The world's largest bird, the ostrich lays the world's largest egg on bare ground and is an easy mark for human hunters. "They're really getting it from both sides," says Monfort. "Adults are being killed and the eggs are being robbed." In many parts of Chad, it's likely that the ostrich now shares the fate of the oryx. So have the many human settlements that once ringed Lake Chad, a shrunken lake straddling Chad's western border with Niger, Nigeria, and Cameroon. Two thousand years ago, the lake extended much farther into Chad's interior where, today, smooth dry lakebeds stand out on the sun-baked plains. On these lonely expanses, Newby, Monfort, Wacher, and their colleagues found many giant catfish bones, pottery shards, stone tools, as well as old ostrich eggshell fragments.

RENEWING RAINS

Despite a dearth of larger animals, the generous winter rains did benefit other wildlife. The team saw more than 4,000 tan-and-white dorcas gazelles, including many young ones. These greyhound-sized, short-horned animals sometimes browsed for leaves within sight of nomads' camels. The team benefited from the expert birding skills of both Wacher—author of a field guide to birds of Senegal and the Gambia—and Newby. They identified almost 200 bird species, including colorful bee-eaters and rollers and three types of bustard. Some of the Sahel's small, dun- colored mammalian predators also made frequent appearances, at least to the camera traps Djadou and Wacher set up each night. Lured by leftover meal scraps, curious animals tripped infrared beams that triggered the cameras. Fennec fox (*Vulpes zerda*), a denizen of open, sandy plains, and the golden jackal (*Canis aureus*), which popped up in habitats from grassland to

desert-stranded palm groves, were the most common. Pallid fox (*Vulpes pallida*), Ruppell's fox (*Vulpes ruppelli*), African wild cat (*Felis libyca*), and striped hyena (*Hyaena hyaena*) made cameo appearances, while pawprints were all that revealed the presence of a pair of sand cats (*Felis margarita*).

As illustrated by the Chad survey, the rain-thirsty Sahelo-Saharan region—while not the world's most biologically diverse area—is very important for wildlife. In addition, many of Europe's migratory birds, from tiny warblers to stately storks, also winter there. Yet the region has received little public attention.

Monfort, Newby, and Wacher have made improving prospects for Sahelo-Saharan wildlife their joint mission. Monfort, a long-time expert on the reproductive biology of scimitar-horned oryx, has helped breed this species at the National Zoo using artificial insemination. At least 2,000 currently live in zoos and other institutions worldwide. But Monfort thinks that restoring animals to the wild is the next important step. "I realized that unless someone spearheaded a reintroduction effort, all of our work with the captive management of the oryx would be for nothing," he says. In 1998, at a meeting of zoo scientists dedicated to antelope breeding, Monfort proposed, and later helped found, the Sahelo-Saharan Interest Group (SSIG). This informal international network now consists of scientists from 14 countries who share research and survey information and strive to chart a course for conserving the region's antelope and other wildlife. Two recent projects spearheaded by SSIG members included the Chad and Niger surveys, as well as other endeavors for training, park development, and reintroduction efforts in Tunisia, Morocco, Senegal, and Algeria. Where possible, these projects target reintroducing antelopes, Barbary sheep (*Ammotragus lervia*), ostrich, and other animals. Newby is also launching a nonprofit organization called Living Deserts, which he hopes will not only increase awareness of desert wildlife's plight but also help devise programs and incentives that involve local people in conservation efforts.

Following this year's Niger trip, Monfort, Newby, Wacher, and their SSIG colleagues plan to push ahead with establishing an Africa-based, arid-land wildlife breeding facility. "The current state of most wildlife populations [of large Sahelo-Saharan animals] requires some form of reintroduction," says Newby. A regional breeding facility would establish a stock of animals and provide a place to train wildlife managers and set up regional conservation programs. Once on the ground, the center will probably take about two years to get going, according to Monfort. "Then, realistically, we're talking about five to ten years to get animals back into the wild," he says. North American and European zoos will be crucial in training African officials to manage Sahelian wildlife.

NOMADIC ARABIAN GIRLS DRIVE GOATS SOUTH AFTER THE BRIEF SAHELIAN WET SEASON.

NOMADS IN THE NORTH DRIVE THEIR CAMELS ACROSS THE SAHARA AS THEY'VE DONE FOR CENTURIES, PUTTING RELATIVELY LITTLE PRESSURE ON THE ECOSYSTEM. IN CONTRAST, WIDESPREAD POVERTY AND A HARSH CLIMATE DICTATE THAT MOST CHADIANS AND NIGERIENS IN THE SOUTHERN SAHEL TRY TO COAX MILLET FROM SCRABBLY SOIL OR HERD LIVESTOCK.

Nomads in the north drive their camels across the Sahara as they've done for centuries, putting relatively little pressure on the ecosystem. In contrast, widespread poverty and a harsh climate dictate that most Chadians and Nigeriens in the southern Sahel try to coax millet from scrabbly soil or herd livestock. Fearing the toll the next drought might take, herders desperately breed as many head of cattle as possible and gravitate toward drilled water wells that keep the herds alive. Traditionally, fewer herders ranged more widely in search of forage for their animals, having less impact on the land. Today's boom-bust mentality and an unwillingness to move herds leads to widespread over-grazing, which degrades habitats important to desert antelope. "With wells, you get herds with access to water but no grazing. You can get a classic dust bowl situation out there," says Newby. Compounding this problem, well-drillers frequently hunt wildlife found near their work sites.

The big problem, according to Newby, is that inhabitants lack alternatives, and there's very little buffer between good and bad years. "Right now, the situation is not improving, so people are destroying their habitat for want of better alternatives," he says. Moreover, the human population is growing fast: Chad has 8.7 million people, and Niger has 10.3 million, growing by 3.3 and 2.7 percent each year, respectively. But the team remains upbeat about balancing the needs of Sahelo-Saharan people and wildlife.

"We believe antelopes and people can coexist," says Monfort, "but both antelope and people of the Sahel are nomadic, and any winning conservation strategy will need to deal with the fact that both compete for the same resources."

Yet, even if local people work toward more sustainable grazing practices, another uncontrolled menace plagues Sahelo-Saharan wildlife—over-hunting. For years, wealthy Middle Eastern hunters and resident soldiers, riding in four-wheel-drive vehicles, hunted the now-extinct oryx. Today, they chase down dorcas gazelles, bustards, and other wildlife. "The impact on wildlife

of poor land use from herding pales in comparison to the impact of over-hunting by hunting parties," says Newby.

Since the team's most recent survey in Chad, they have learned that tourist hunters from Persian Gulf states have driven into the Ouadi Rimé-Ouadi Achim Faunal Reserve and killed 470 Nubian (*Neotis nuba*), white-bellied (*Eupodotis senegalensis*), and Arabian (*Ardeotis arabs*) bustards. "We were extremely disappointed. Someone granted them access to the area, and money was certainly involved," says Monfort. Newby shares Monfort's disappointment. "Any kind of benefit the rains brought is totally wiped out by unsustainable hunting." Except in a few big-game hunting zones in the south, hunting is illegal in Chad and Niger. However, enforcement is difficult. Chad and Niger have central governments, but many areas are governed regionally by tribal factions whose support will be critical to the success of any conservation initiatives. In addition, hunting parties sometimes buy access to wildlife areas from local government or leaders by paying for a mosque, a well, or some other community project.

WITH THE SINKING OF MODERN WELLS, WILDLIFE FACES MORE PRESSURE FROM POACHING AND GRAZING.

While conservationists plot their strategy for how to balance human and wildlife needs, zoos already supply some Sahelo-Saharan countries with antelopes the zoos have been breeding for years. For logistical reasons, most antelopes reintroduced into North Africa derive from European zoos, a factor which limits genetic diversity. "This situation must change in the future," says Monfort, "because a substantial proportion of the [gene pool] needed for establishing a 'world herd' exists in North American zoos."

Although the challenges are daunting, the region's wildlife picture is not all bad. Tunisian national parks have embarked upon reintroduction programs to acclimate, breed, and release Cuvier's and slender-horned gazelles born in German and Spanish zoos and scimitar-horned oryx from six zoos in five countries. In two Moroccan parks, addax, oryx, dorcas gazelles, as well as introduced dama gazelles and ostrich, are in place or being introduced. In Algeria, where political violence led to a government ban on firearms, wildlife populations are bouncing back. Barbary sheep, cheetah, Cuvier's gazelles, and addax populations are growing, and oryx and dama gazelles may someday be reintroduced there.

Since the mid-1980s, Senegal, at the Sahel's far western corner, has hosted a growing herd of dama gazelles and scimitar-horned oryx. From eight gazelles, contributed by a Spanish zoo in 1984, and eight oryx given by an Israeli zoo in 1999, the populations have increased to 49 and 18, respectively. These animals live in a 20-acre enclosure within a faunal reserve, and the opportunity to observe the behavior and welfare of these pioneer animals has made officials better prepared for future additions.

These introductions bring up an important step in restoring Sahelo-Saharan antelope populations—though not an ultimate solution—which is the issue of fencing. "All reintroductions in North Africa to date have involved fenced releases," says Wacher, one of the world's foremost experts on antelope reintroduction. Wacher does much of his work at the King Khalid Wildlife Research Center in Saudi Arabia, a wildlife reserve and breeding center run by the Saudi National Commission for Wildlife Conservation and Development. There, he helps manage one of only two unfenced arid-land antelope releases. What Wacher and his colleagues learned by studying released sand gazelles (*Gazella subgutturosa*) in Saudi Arabia will apply to efforts to restore Sahelo-Saharan antelopes. "When you put a whole population together, they radiate out and over the course of time they span a very, very large area," Wacher says. Over a period of 18 months, a majority of the gazelles ranged between 770 and 1,160 square miles. However, 300 gazelles ranged up to 15,400 square miles—an area about the size of Maryland and Delaware combined. Some even popped up in neighboring Yemen.

The largest North African fenced area is nearly eight square miles—100 times smaller than the average home range of the Saudi antelope. "What that tells you straight away is that you're never going to restore the ecology of a species in an area like that," says Wacher. "Fenced areas are very useful tools to instill interest and get projects off the ground, but it's not really a reintroduction at this point if you mean to restore natural processes," he says. In Saudi Arabia, Wacher also monitors a fenced area of 770 square miles into which oryx and gazelle were introduced. After fewer than ten years, the gazelle population crashed when drought stressed the animals and they concentrated in one fenced corner of the reserve. Wacher is not against fenced releases in principle, but warns that even 770 square miles is not enough, and there must be hands-on management. "In the central Sahara, that might not be easy to do. There must be somewhere in the Sahara where you can reintroduce these animals on a big scale," says Wacher.

Yet, fenced releases mark an important beginning, an example of how—from zoos to fenced enclosures to open range—the region's wildlife may someday tiptoe its way back to prominence, with local involvement, institutional cooperation—and a little bit of cooperation from the weather. Z

—Howard Youth is a contributing editor to ZooGoer.

JOHN R. FORD

OWL

GREENING THE BIG APPLE

JENNIFER USCHER

PROWL

Bob DeCandido was smiling, clutching a neon-yellow boom box in one hand and an industrial-strength flashlight in the other. On a chilly April night, DeCandido and I had ventured into the lush darkness of Central Park's North Woods accompanied by a rowdy Boy Scout troop and several birdwatchers. We would pause every few moments as DeCandido, a ranger for the New York City Parks Department, held the stereo high above his head, pointed the speakers at the sky, and played the tape.

The sound that emerged was an eerie, plaintive trill, descending in tone. It echoed off the trees, resembling the whinny of an agitated horse. We waited and waited. No response. "It's like trying to contact aliens," whispered a frustrated birder. "How do we even know if we're using the right language?"

The alien we were trying to contact that night two years ago was the eastern screech-owl (*Otus asio*), a diminutive bird, no taller than a soda can, that is found in woodlands east of the Rockies from northeast Mexico to the boreal forests of Canada. No one knows exactly why these tiny, fearless birds respond to taped calls. They could view it as a threat from a competitor, or the come-on of a potential mate. It may be that they are just curious or lonely. If you're lucky, they'll call back to your tape, alight on a nearby branch, and allow you to shine your flashlight on their face.

At this point, I had been on three of these Central Park "owl prowls" in as many weeks and had yet to see a single one of these elusive nocturnal predators. (We did at one point mistake a far-off police siren for a possible lovesick owl.) The anticipation of our ongoing search was heightened by the fact that we were witnessing a unique experiment in urban ecology.

DEBORAH ALLEN

JUVENILE RED-TAILED HAWKS PERCHING ON A PARK BENCH.

After breeding in Central Park for decades, screech-owls vanished in the early 1960s, perhaps due to poisoning, removal of dead and dying trees in which they nested, or starvation during a particularly harsh winter. Due to the fact that screech-owls don't migrate in significant numbers, once they disappear from an area they are often gone for good. But Bob DeCandido, a biologist who works on wildlife reintroductions for the Parks Department, believed he could bring them back. DeCandido estimates that Central Park could sustain several breeding pairs because the ecosystem in the park appears healthier than it had been in the 1960s, with plenty of prey to sustain the owls—including rodents, earthworms, fish, and birds—as well as dead trees for roosting and nesting. Furthermore, screech-owls have been breeding successfully in Inwood Hill Park in northern Manhattan for many years.

A man with a contagious passion for nature, DeCandido became intrigued with birds of prey in his early 20s when he was surprised to spot owls and hawks during early-morning jogs in Pelham Bay Park in the Bronx. He then volunteered for an organization called The Peregrine Fund, which dropped him into the remote mountains of California's Lassen Volcanic Park, along with a 25-pound bag of rice, to study a pair of peregrine falcons (*Falco peregrinus*) for six weeks. During this stint, DeCandido grew a beard, lost a lot of weight, and developed a life-long commitment to studying and helping protect birds of prey. Now, he's out on the mean streets of New York City to further this quest.

"IT'S LIKE TRYING TO CONTACT ALIENS," WHISPERED A FRUSTRATED BIRDER.

Rats slithering down oily subway tracks, roaches scampering behind the walls, pigeons befouling the sidewalk—these are the images many have of New York City's wildlife. While it's true that the city is hospitable to those tough, street-smart scavengers, it also hosts a surprising diversity of other creatures that one might associate with more pristine wilderness.

In Inwood Hill Park, located on the northern tip of Manhattan, wild turkeys (*Meleagris gallopavo*) forage in the brush while southern flying squirrels (*Glaucomys volans*) leap between tree branches, and little brown bats (*Myotis lucifugus*) skitter overhead. Bright green South American monk parakeets (*Myiopsitta monachus*)—escaped pets who've established breeding colonies in several boroughs—dine at backyard bird feeders and nest in the gothic spires at the entrance to Green-Wood Cemetery in Brooklyn. Black-tailed jackrabbits (*Lepus californicus*) hop through high grasses, while diamondback terrapins (*Malaclemys terrapin*) inch across the runways to lay their eggs at JFK Airport in Queens. A peregrine falcon tosses a pigeon to its five downy nestlings in a nest perched on the 14th-floor windowsill of a Wall Street skyscraper. Harbor seals (*Phoca vitulina*) and gray seals (*Halichoerus griseus*) sun themselves on rock shoals at the western end of Long Island Sound in the Bronx. Elegant, long-necked wading birds, such as black-crowned night herons (*Nycticorax nycticorax*), snowy egrets (*Egretta thula*), and glossy ibis (*Plegadis falcinellus*), nest on tiny islands in New York Harbor, indifferent to the passing trash barges and oil tankers. New Yorkers can witness most of these scenes for the price of a round-trip subway or bus fare.

How could this diversity of species call the same city home? New York is built on a series of islands where the Hudson River, Long Island Sound, and the Atlantic Ocean come together. The city has more than 28,000 acres of parkland comprising a great variety of habitats from woodlands to grasslands, ponds, marshes, and sand dunes. Enclosed on all sides by concrete high-rises in the middle of Manhattan, Central Park alone boasts 843 acres of forests, meadows, and ponds.

With more than 350 resident and migratory bird species found in such a concentrated and

DEBORAH ALLEN

AN URBAN PARK RANGER LEADS A BIRD WALK IN CENTRAL PARK.

accessible area, it's not surprising that New York City hosts one of the world's largest and most devoted cadres of birdwatchers. Last year, birders in Central Park recorded more than 200 species, including thrushes, tanagers, woodpeckers, vultures, shrikes, flycatchers, and swallows. The city's parks are appealing to avian migrants who, after flying over expanses of concrete and highway, are drawn to these inviting patches of green. On a warm morning in May you can spot tiny, brilliantly colored warblers like northern parulas (*Parula americana*), American redstarts (*Setophaga ruticilla*), and common yellowthroats (*Geothlypis trichas*). As many as 30 warbler species drop by the city's parks to gorge themselves on bugs while returning from their winter homes in Mexico, the Caribbean, and South and Central America. In the excitement of straining to identify each one, you're likely to develop what Central Park birders call "warbler neck."

SCREECHING ABOUT OWL REINTRODUCTION

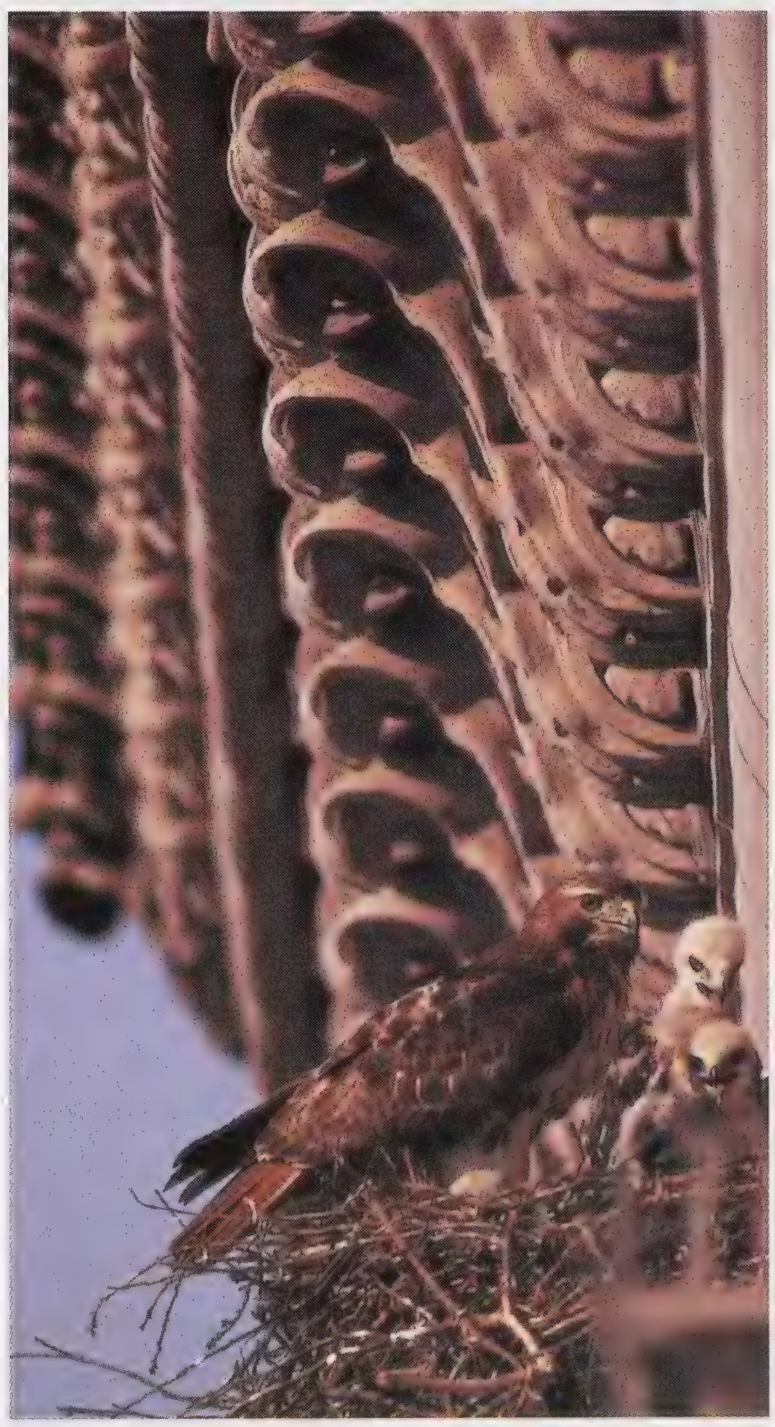
Despite the city's birding fervor, not everyone has supported the screech-owl reintroduction. Far from endangered, screech-owls are one of the most common owls in the Northeast. When the Parks Department first announced its plans in 1998, concerned citizens from a group called the Woodlands Advisory Board objected to aspects of the project. They believed it was irresponsible to reintroduce the owls, as the cause of their original disappearance remained still unclear. The project, they claimed, was nothing more than a public-relations stunt.

But the biodiversity team could point to a promising precedent for reintroducing birds of prey in big cities. Since the 1970s, captive-bred peregrine falcons have been successfully reintroduced in New York, Chicago, Atlanta, and Baltimore, among others. Though falcons face different threats in the city than in rural areas (for example, crashing into moving vehicles, colliding with the reflective-glass walls of buildings, or, in the case of fledglings, falling down chimneys), biologists believe that they do well in cities because of the abundance of prey and the absence of predators. Today, savvy urban peregrines nest contentedly on such prominent landmarks as Manhattan's Met-Life building and the Brooklyn Bridge.

The screech-owl reintroduction was just one in a series of attempts by the New York City Parks Department to bring back lost native plants and animals in an effort to increase the biodiversity of the city's natural habitats. Project-X, as the city-wide initiative is known, began in 1997 with the reintroductions of butterfly weed (*Asclepias tuberosa*), bird's foot violet (*Viola pedata*), Fowler's toads (*Bufo fowleri*), eastern box turtles (*Terrapene carolina*), and woodchucks (*Marmota monax*). So far, more than 36 different plant species and 23 animal species have been reintroduced to parks in all five boroughs.

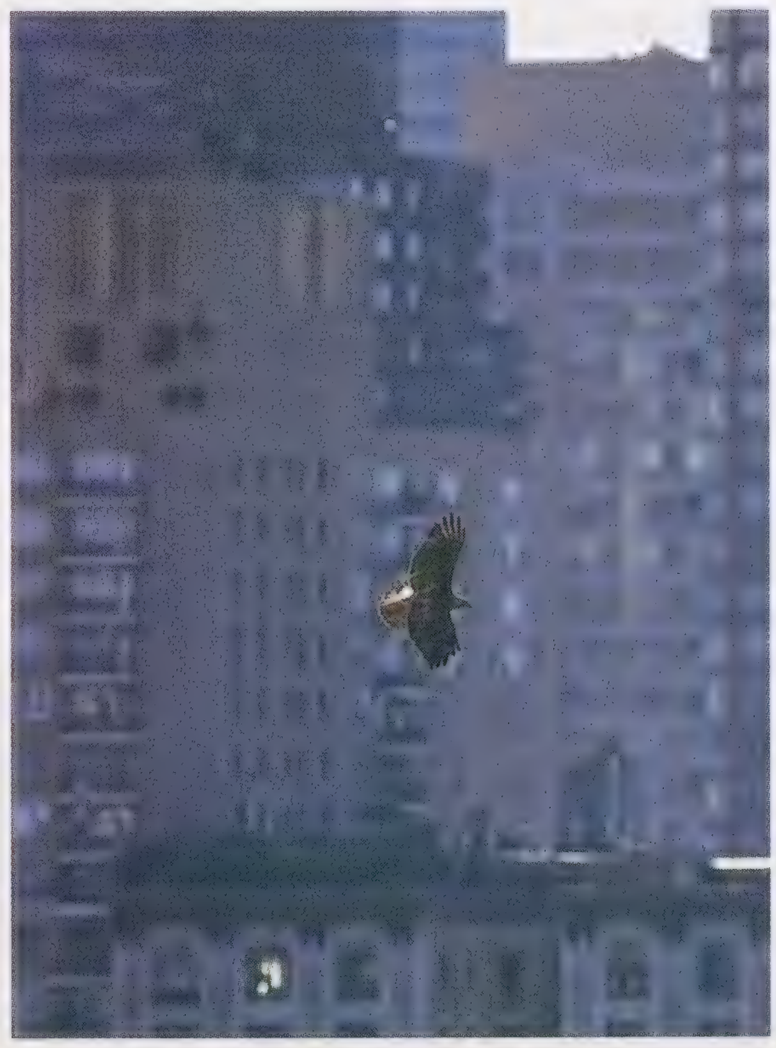
DEBORAH ALLEN

AMERICAN KESTREL (*FALCO SPARVERIUS*) NESTLINGS, WATER STREET, NEW YORK CITY.



DEBORAH ALLEN

ADULT RED-TAILED HAWK "BLUE" AT NEST WITH YOUNG.



DEBORAH ALLEN

ADULT MALE RED-TAILED HAWK "PALE MALE" FLIES OVER CENTRAL PARK.

JOHN R. FORD

SCREECH-OWL WITH PREY.

DEBORAH ALLEN

DEBORAH ALLEN

EASTERN SCREECH-OWL RELEASE.

DEBORAH ALLEN

"The Parks Department has done significant restoration to many of these habitats," according to E.J. McAdams, biodiversity coordinator for the Urban Park Rangers. "Migratory species are finding their way back, so we try to reintroduce nonmigratory species that wouldn't have been able to come back otherwise." Yet the many failed Project-X reintroductions demonstrate that the odds might be against such long-lost species making a comeback. For example, 28 bobwhite quail (*Colinus virginianus*) released in Pelham Bay Park in 1998 were eaten by such predators as feral cats within a month. The ebony jewelwing damselflies (*Calopteryx maculata*) released in Central Park laid eggs on a lake in the northern end of the park, but they don't appear to have hatched, and the rangers now hypothesize the eggs or the nymphs themselves were eaten by birds. No one knows what became of the luna moths (*Actias luna*) or spring peepers (*Pseudacris crucifer*) that simply disappeared shortly after their release.

Though Project-X may have failed to reestablish these species, the publicity surrounding the projects may be doing something even more vital for urban wildlife: piquing the public's interest in their fate. The Parks Department believes that reintroducing the charismatic screech-owl to Central Park—the city's most visited park and a mecca for bird-watchers from around the world—would have not only scientific but aesthetic and educational value.

ROBERT DECANDIDO

LUNA MOTH.

Eastern screech-owls rarely exceed eight inches in height, but like their much larger cousin (and primary predator), the nearly two-foot-tall great horned owl (*Bubo virginianus*), screech-owls have prominent wide-set feathered ear tufts. These "horns," along with the screech-owl's large, lemon-yellow eyes, lend them an elfin and mischievous appearance. They can be one of two colors: a silvery gray or a cinnamon red. They're hardy, highly adaptable birds and, despite their diminutive size, have a fierce personality. Screech-owls are sit-and-wait predators, stealthily eyeing their prey and then diving quickly to seize it in their talons. They'll easily attack, subdue, and carry home prey that weighs more than they do, such as the infamous brown rat (*Rattus norvegicus*). Unlike many birds of their size, screech-owls project a zen-like calm and confidence that comes from luxuriating in their high place on the food chain.

In August 1998, six young screech-owls, which were born in the wild but raised by wildlife rehabilitators in New Jersey, were banded and released in an evening ceremony in Central Park. Bob DeCandido held his breath as the owls flew silently into the trees in different directions amidst

EASTERN SCREECH-OWL, GRAY-PHASE.

the glare of flashing cameras. These birds had already survived a harrowing childhood; five of them were siblings orphaned when their mother was cut in half by a chainsaw as she sat in a hollow tree. Three and a half years after their release, only one of the original six owls is known to be living in Central Park. One was found dead in 1999, apparently hit by a car, while another was discovered in shock and returned to captivity. The fate of the other three is unknown. Still, DeCandido is encouraged by the rate of survival: "Sixty to seventy percent of screech-owls in the wild don't make it past their first year, so we're actually doing well."

DUE TO THE FACT THAT SCREECH-OWLS DON'T MIGRATE IN SIGNIFICANT NUMBERS, ONCE THEY DISAPPEAR FROM AN AREA THEY ARE OFTEN GONE FOR GOOD.

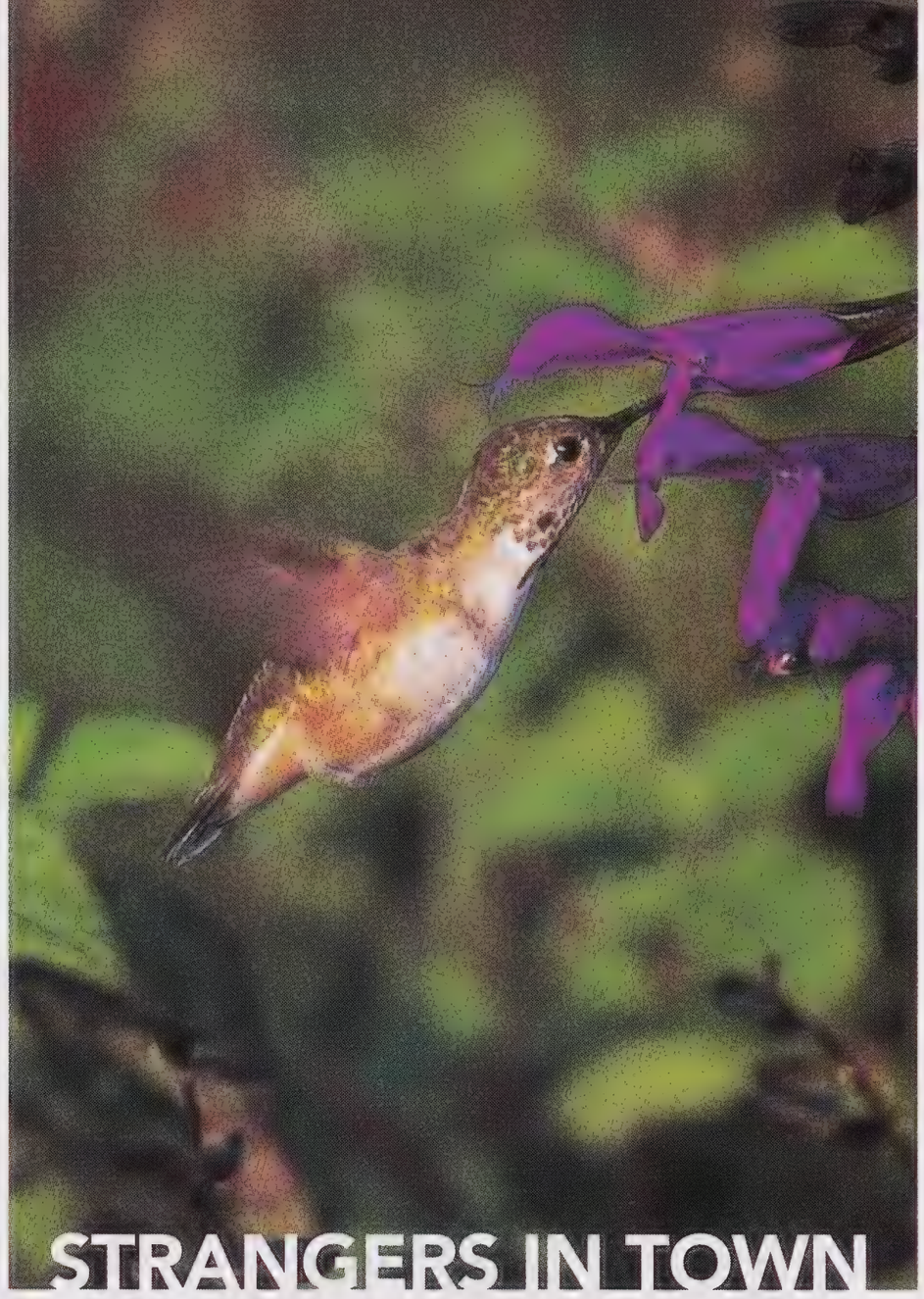
Throughout 2000 and 2001, I joined DeCandido on evening walks to search for the owls. On many nights we got not a single response. DeCandido admits that tape playback censusing is not always efficient—but it's far easier than trying to spot owls during the day. Screech-owls spend most of the daylight hours sleeping on branches or in tree hollows, and their posture and bark-like feather patterns allow them exquisite camouflage. I've seen them affecting this roosting stance: eyes closed to mere slits, ear tufts raised to points, facial feathers aligned perfectly to simulate bark furrows. A fluffed-up ball of feathers, they resemble nothing so much as a sleeping Furby. When they do respond to the tape, it's indescribably exciting.

On a walk in the late spring of 2000, the birders were milling about, chatty and inattentive after two hours of fruitless wandering in the Ramble, a wooded, hilly area in the middle of the park. I was still poised and ready, holding my breath, straining my ears, and grasping my binoculars. I perceived what at first sounded like a trick of the ear, perhaps a distant echo of the playback. DeCandido mimed to everyone to pay attention, and suddenly the crowd let out a collective, almost frightened gasp as we felt the whoosh of dark wings swooping over our heads. DeCandido scanned the nearby treetops with his flashlight and, sure enough, a screech-owl had landed in a branch only 15 feet above us. It continuously called back to the tape in a higher-pitched, sweet and curious purr. Its presence was at once ghostly and warm.

After a moment, the owl flew to another branch directly above the tape player, perhaps trying to pick out an imagined companion. Its 20-inch wingspan in flight was incredible—I could hardly believe a bird roughly the size of a man's fist when perched can take on such proportions in the air. We walked to the main pathway, where DeCandido played the tape one more time. The owl actually followed us to our new spot, landing in a tree beside the path. 'Don't go' it seemed to be urging. The owl appeared more eager to make contact than even we were.

Luckily, it would soon have new neighbors. The Parks Department expanded the screech-owl reintroduction project in the summer of 2001, teaming with William Giuliano, a wildlife ecologist at Fordham University who has studied and tracked screech-owls in Kentucky. Along with a graduate student, Chris Nagy, two undergraduate assistants, and the biodiversity team, Giuliano set about surveying the parks for suitable habitat, obtaining owls from rehabilitators in three states, preparing them for release, and then monitoring them by radio-telemetry.

Last September and October, another group of 18 owls that had hatched the previous spring, but were orphaned and raised in captivity, were released in three wooded locations throughout



DEBORAH ALLEN

CALLIOPE HUMMINGBIRD, FORT TRYON PARK.

Central Park. But unlike the birds in the first release, each was fitted with a radio transmitter enclosed in a strap-on backpack slightly bigger than a nickel. The transmitter gives off a signal that allows it to be tracked from as far as a mile away. Researchers now can monitor and collect data on the birds' mortality, nesting patterns, and foraging habits in a much more detailed and reliable fashion.

I met Nagy and the rangers for a release on the terrace in front of Belvedere Castle—the highest spot in Central Park—on a cool, humid night in late September. Ranger James MacDonald had spent the previous few hours trying to attach backpack transmitters to the recalcitrant owls, one of which bit him through a thick leather glove and would not let go. Somehow he was still charmed by the birds. "They're the most endearing animals I've ever worked with," MacDonald confided, calling them, "fuzzy lumps of malice and personality."

Nagy set down a powder-pink dog carrier, which had been used to transport three screech-owls flown in from Michigan earlier that day. He cautiously opened the top and instructed us all to back away and stay silent. Immediately, one owl darted out toward the tall trees lining the edge of the Great Lawn below. The two others remained in the carrier, disoriented, no doubt, by their hectic travels and this first, confusing offer of freedom. We waited ten long minutes, watching tiny ear tufts peek out of the carrier. I was starting to get impatient when they took off simultaneously, heading in the same direction as the first owl and barreling into the darkness in frenetic flight.

Within a month, seven of the 18 released owls had nibbled their way out of their backpacks, but Nagy managed to trap and refit several of them. Three birds from the fall 2001 release are known to be dead (one died from starvation, one from head injuries, and one from pesticide poisoning). A fourth sick bird is being rehabilitated and may soon be returned to the wild. However, the owls appear to be gaining confidence as they have expanded their hunting territories and are venturing out beyond the limits of the park. Nagy tracked an owl to the walls around the Metropolitan Museum of Art. Another owl spent a couple of days hunting in a construction site on Madison Avenue. The boldest one took a jaunt north to Morningside Park at 123rd Street. Though this park is nearly adjacent to Central Park, E.J. McAdams of the Urban Park Rangers theorizes that the owl must have navigated through at least a couple of busy city avenues to get there.

"The owls use the urban environment to their advantage," says McAdams, pointing out that they are frequently found hunting near lamps in the park. "They seem to use the light source so they have a better chance of grabbing prey." Surprisingly, the owls are also unfazed by human activity and noise, happily ignoring passing cars, bikers, and the deafening pop music from a nearby skating rink. They react to the sounds of other animals, however. The

STRANGERS IN TOWN

JENNIFER USCHER

Nothing fires up the birdwatching crowd more than the sighting of an extremely rare bird. So when a pair of disoriented calliope hummingbirds (*Stellula calliope*) wound up spending last November and December dining on the salvia bushes in Fort Tryon Park in northern Manhattan, birders, photographers, and the media snapped to attention. It was the first ever calliope sighting in New York State.

The two immature males had traveled east from British Columbia instead of south to their winter range in Mexico. "People saw them as lost teenagers hitchhiking across the continent," says David Burg, president of WildMetro, an organization devoted to protecting nature in cities.

As the weeks went by and frosts wiped out many flowers, concern for the pair grew. Burg consulted hummingbird experts to find out whether they had a chance of surviving a chilly NYC winter and organized a group of volunteers who put out nectar feeders, which the hummers never figured out how to use. He also considered trapping them so they could spend the winter in captivity in the Bronx Zoo. Then, in late December, the hummingbirds disappeared. Nobody knows whether the pair continued their journey or perished, but Burg is optimistic because calliopes have survived cold weather elsewhere.

Some came to think of the strange, beautiful sight of these birds as a gift that helped ease the city's sadness after the tragic events of September 11th. "To have a visitation like that—it really came at a time when people needed that little spark of joy," says Burg. "They were almost like fairy apparitions among the purple flowers."

rangers once watched an owl scoping out prey by the East Drive when suddenly an ambulance came around the corner with its sirens blaring and its lights flashing. The owl didn't miss a beat, eyes fixed on the ground to find prey. Later a horse-drawn carriage came around the same bend, and the horse let out a loud neigh. The owl turned around to watch the horse. "It's fascinating to notice how they make those distinctions," says McAdams. They've also learned how to mark their turf, even against much larger birds. DeCandido was pleased to see a young owl make a territorial whinny when it glimpsed a red-tailed hawk (*Buteo jamaicensis*) circling overhead at dusk.

Best of all, several owls have paired off, and the rangers have observed courtship behaviors, such as food sharing. In December, two owls were spotted flying together and then mating. It was thrilling to learn that the female of this amorous couple was the one that we had seen alone in the Ramble for the past two years. She had at last found a mate. If the owls breed this year, it will be a real feather in the cap for the project and a sign that a self-sustaining population of owls in Central Park—unseen ambassadors for the city's native biodiversity—is possible. The Parks Department plans to continue tracking the owls for at least another year and is considering releasing more owls next fall.

In the city that never sleeps, nocturnal wildlife is back. Z

—Jennifer Uscher, a graduate student at Columbia University, writes about birds for such publications as Wildlife Conservation, Popular Science, *and* Natural New England. *She can be reached at jbu3@columbia.edu.*

DEBORAH ALLEN

BEHIND ITS SCREEN, AN EASTERN SCREECH-OWL HUNTS IN CENTRAL PARK.

STORY BY
JILL LOCANTORE

AT THE ZOO:

PHOTOS BY
JESSIE COHEN

THE NAKED TRUTH ABOUT MOLE-RATS

Endowed with pinkish-gray, wrinkly skin, scant hair, and long buck teeth, naked mole-rats (*Heterocephalus glaber*) aren't likely to win any beauty contests. Some might refer to them as downright ugly, resembling an overcooked hotdog with teeth. Nonetheless, biologists and zoogoers are enchanted with these bizarre rodents.

THE ZOO'S NAKED MOLE-RATS HAVE A MAZE OF CLEAR PLASTIC TUNNELS FOR THEIR HABITAT.

NAKE MOLE-RATS FIND THE END OF THE LINE.

Naked mole-rats spend virtually their entire lives in the total darkness of underground burrows. Ensconced in the arid soils of Africa, these three-inch-long creatures must continually dig tunnels in search of sporadic food supplies and evade the deadly jaws of snakes. Within this formidable environment, naked mole-rats have broken many mammalian rules and evolved an oddly insect-like social system.

Despite the fact that they burrow underground like moles and have rat-like tails, naked mole-rats are in fact neither moles nor rats. The majority of the species referred to as mole-rats belong instead to the family Bathyergidae and are more closely related to porcupines, chinchillas, and guinea pigs than to their namesakes. Thirty-seven other species, such as the Palestine mole-rat (*Spalex ehrenbergi*), are also referred to as mole-rats but share only superficial similarities to the Bathyergidae and to one another.

Mole-rats of the family Bathyergidae are endemic to sub-Saharan Africa, where they can be found just about anywhere there are plants with large underground roots and tubers—the staple of mole-rats' diet. Naked mole-rats are limited to the horn of Africa, including parts of Somalia, Ethiopia, and Kenya. They are the only mole-rat species that lacks typical rodent fur. However, that's not the only thing that makes them odd.

Much like ants, termites, and some bees and wasps, naked mole-rats are considered "eusocial," or truly social. They live in large colonies, presided over by a queen, in which only the queen and a few select males breed while the rest of the colony—all members of the same family—work together to raise young and maintain the colony. Wild colonies range in size from 20 to 300 individuals, with an average colony consisting of 75 individuals. The Smithsonian's National Zoo houses three colonies, the largest of which boasts more than 50 mole-rats. Visitors to the Small Mammal House can examine one of these colonies, which occupies a labyrinth of transparent tubes. The Zoo also displays a colony of Damaraland mole-rats (*Cryptomys damarensis*), which are also eusocial, and a Palestine mole-rat, which lives solitarily as it would in the wild.

Native Africans have long known of the existence of naked mole-rats, which they call sand puppies. Rarely making appearances above ground, naked mole-rats didn't capture the attention of Western biologists until the mid-1970s, when pioneering researchers Jennifer Jarvis, now affiliated with the University of Cape

Town, Paul Sherman from Cornell University, and Richard Alexander at the University of Michigan uncovered the rodents' secret societies.

Naked mole-rat colonies are organized into strict hierarchical castes. At the top of the heap—second only to the ruling matriarch—is the queen's harem of one to three males with whom she chooses to mate. Beneath these high-status breeders are soldiers—both male and female—who defend the colony against predators and foreign mole-rats. Odors distinguish friends from foes. To achieve a recognizable odor, naked mole-rats often roll about in the burrow's toilet chamber, coating their body with the familiar scent of the colony's feces and urine. Extremely xenophobic, naked mole-rats will fiercely attack unfamiliar intruders that may be encountered when one colony breaks into the burrow of another.

At the bottom of the social totem pole, and smallest in size, are the workers, who are responsible for maintaining the burrow, finding food, and caring for the queen and her pups. So dependent are naked mole-rats on their social lifestyle that individual zoo mole-rats kept in isolation will die. "The entire colony is like one big organism," says David Kessler, an animal keeper at the National Zoo's Small Mammal House.

Because only a few members of the colony produce all the young, and the queen typically mates with close relatives selected from within the colony, naked mole-rat colonies are highly inbred. In fact, colony members are so closely related that their DNA 'fingerprints' are virtually identical. Even though individual workers may not reproduce, many of their same genes are carried and passed on by others in the colony. In this eusocial scheme, naked mole-rats that sacrifice the opportunity to reproduce pass down their genes indirectly by caring for their colony mates.

The bossy queen rules her brood with brute force, often venturing from her nest to check up on subordinates. Researchers Paul Sherman and Kern Reeve from Cornell observed that if the queen discovers more food is needed, a tunnel has caved in, or danger is near she will shove the workers and soldiers around, prodding them into action. The queen also seems to use prolonged nose-to-nose shoving to prevent other naked mole-rats from breeding. Researchers Chris Faulkes of Queen Mary & Westfield College, London, and Frank Clarke of the University of Aberdeen discovered that the queen gets particularly pushy when she is close to breeding or when she senses that a non-breeder is about to become reproductively active. The researchers speculate that shoving may cause stress and inhibit hormone release, which in turn prevents ovulation in females and leads to lower testosterone and sperm count in males. Whatever the mechanism, the vast majority of naked mole-rats are doomed to a life of celibacy.

NATIVE AFRICANS HAVE LONG KNOWN OF THE EXISTENCE OF NAKED MOLE-RATS, WHICH THEY CALL SAND PUPPIES.

Undistracted by courtship and parenthood, workers focus most of their energy on one activity—digging. Their large, sharp incisors make ideal digging tools. The four front teeth—two on the top and two on the bottom—are actually located outside the mouth. To keep from swallowing unwanted dirt, hairy lips close behind the teeth, as do skin folds at the sides of the mouth.

Powerful jaw muscles add steam-shovel power to the digging apparatus. Twenty-five percent of a naked mole-rat's muscle mass is devoted to closing the jaw, the same proportion of muscle that humans have in each leg. By contrast, only one percent of a human's muscle mass is located in the jaw. Similarly, a large proportion of the naked mole-rat's brain—one third of the cortex—is devoted to processing information from the area around the teeth.

The incisors can be moved independently, spread apart, or moved together like chopsticks. To compensate for the wear and tear of digging, naked mole-rats' incisors grow continuously throughout their lives. At the Zoo, mole-rats are kept in clear plastic tubes and chambers that can't be dug through (although that doesn't stop the mole-rats from trying). Each day the keepers fill the tubes with wood chips and food for the mole-rats to gnaw on. Mole-rats also grind their teeth in their sleep. Occasionally, a Zoo mole-rat's incisors will grow to an unwieldy size. "When that happens, we just trim their teeth with nail clippers," Kessler explains.

NAKED MOLE-RAT REVEALS ITSELF AND TRIES TO TUNNEL THROUGH ITS PLASTIC TUNNELS (RIGHT).

When working together to dig tunnels in the wild, naked mole-rats line up nose to tail and operate like a conveyor belt. A digger mole-rat at the front uses its teeth to break through new soil. Behind the digger, sweepers use their feet and the fine hairs between their toes to whisk the dirt backwards. At the back of the line a 'volcanoer' kicks the dirt up onto the surface of the ground, creating a distinctive, volcano-shaped mole hill about the height of a ballpoint pen.

Working as a team, naked mole-rats make for extremely efficient excavators. Robert Brett of the Zoological Society of London once observed a naked mole-rat colony dig a mile-long tunnel in less than three months. In all, a typical underground colony of about 80 animals can cover the area of twenty football fields. If all the tunnels were laid out in a straight line, they would extend to several miles in length. Branching, interconnected networks of tunnels link up nest areas, toilet chambers, and food sources. Major 'highway' tunnels are wide enough for two naked mole-rats to travel side by side and include turnouts for the animals to back into and change directions. Smaller side tunnels are less than two inches across, but tight squeezes aren't a problem. With skin so loose that they can wriggle halfway around inside of it, naked mole-rats easily get through tight spots.

AT THE TOP OF THE HEAP—SECOND ONLY TO THE RULING MATRIARCH—IS THE QUEEN'S HAREM OF ONE TO THREE MALES WITH WHOM SHE CHOOSES TO MATE.

Their burrows are dark and stuffy places, and naked mole-rats have evolved to survive in these low-oxygen, high-carbon-dioxide environments. Their metabolic rate is less than half that of a typical rodent, and their specially adapted hemoglobin efficiently captures oxygen for the blood stream. A lower metabolism also may help prevent naked mole-rats from overheating during vigorous digging. Unlike other mammals, naked mole-rats aren't capable of physiologically regulating their body temperature. They lack sweat glands and have no insulating layer of fat beneath their thin skin. More like reptiles, their body temperature fluctuates with the temperature of their environment. Fortunately, the temperature in underground burrows remains relatively constant at a toasty 82° to 89°F. To slow heat loss, naked mole-rats sleep together in one big huddle of naked bodies. Individuals sometimes warm up by basking in tunnels just beneath the surface that have been heated by the sun. Sherman speculates that warmed mole-rats may return to the nest and share their heat with others, like living hot-water bottles.

After millions of years of living in the dark, the naked mole-rat's eyes have shrunk to the point that they can hardly see. They often run through tunnels with their tiny eyes closed. In fact, the eyes may be more useful as sensors of moving air currents. For example, when a predator breaks through a sealed burrow entrance, a blast of fresh air is sent down the tunnel, alerting mole-rats to the predator's presence. Naked mole-rats are also very sensitive to vibrations in the ground that may warn of nearby danger. Whiskers on their faces and tails brush along tunnel walls, guiding them in much the same way that a person may use her hands to feel along the wall of a darkened room. Since they aren't looking where they're going anyway, naked mole-rats can run just as fast backwards as forwards.

Predators, such as the rufous-beaked snake (*Rhamphiophis oxyrhynchus rostratus*), are attracted to the smell of freshly dug soil and will slither into burrows through mole hills in search of a rodent meal. Soldier mole-rats fight back with their teeth and attempt to block the entrance with dirt. If all else fails, a soldier will directly attack the snake, sometimes sacrificing its own life while others escape.

The ultimate goal of all the digging is the discovery of a tasty root or tuber to share with the colony. Many plants in arid climates develop fleshy tubers underground that can grow larger than a soccer ball. Naked mole-rats will eat out the succulent center and leave the outer skin intact. This allows the plant to regenerate, providing a reliable source of food. Naked mole-rats don't drink any water and must obtain all their hydration from the plants that they eat. Their

DAMARLAND MOLE-RATS (RIGHT AND BELOW) LIVE SOCIALLY, WHEREAS THE PALESTINE MOLE-RAT (LEFT) HAS A SOLITARY EXISTANCE.

high-cellulose diet is also rather hard to digest, and their stomachs and intestines are inhabited by lots of microscopic organisms—bacteria, fungi, and protozoa—that help break down the vegetable matter. Naked mole-rats also re-ingest their own feces in order to maximize the amount of nutrients they get from their food.

Selfless by nature, naked mole-rats happily share their food with colony-mates. Biologist Paul Sherman studied such foraging behavior in his laboratory at Cornell University. He observed that when an individual mole-rat discovers a new food source it will grab a chunk and scurry back to the nest, chirping all the way. Upon arrival at the nest, the food scout will wave the morsel aloft for all to smell. This chirp-and-wave maneuver sets off a small stampede, as workers race to collect more food and bring it back to feed the whole colony. Sherman believes the rodents are following a chemical trail or signature scent left by the scouting mole-rat.

With all her food and security needs looked after by her minions, the queen is able to devote much of her time and energy to producing and caring for pups. When a female becomes queen she actually grows in length by increasing the space between the vertebrae of her backbone. The queen's elongated body allows her to carry large litters during her pregnancy while still fitting through the narrow tunnels of the burrow. Naked mole-rats are unique among mammals for their prolific reproduction. The typical litter consists of 12 pups, but can be as large as 27. Gestation takes just ten to 11 weeks, and queens may have four or five litters each year. Hundreds of pups have been born at the National Zoo since the first colony arrived ten years ago; many of these are transferred to other zoos around the nation.

The ordered world of naked mole-rats rapidly disintegrates into chaos when a colony's queen weakens or dies. High-ranking females—typically larger solider mole-rats—gain weight and begin fighting for ascension to the throne, sometimes to the death. They shove, bite, and fence with their large incisors. The battle in the burrow may go on for weeks or even months before one female vanquishes all her adversaries and emerges as the new queen.

Scientists once thought that the only way a new colony was established was when a large colony split apart. However, recent research by biologist Justin O'Riain of Cape Town University discovered that, within a colony, there may be a few naked mole-rats that are fatter and lazier than the rest and, ironically, seem to have the urge to travel. Both males and females of this type may eventually leave the colony, traveling by night up to a mile away in search of a partner to mate with and establish a new colony.

The intensely social nature of mole-rats continues to fascinate biologists. While eusociality is common among many insects, the naked mole-rat and its larger, hairier cousin, the Damaraland mole-rat, are the only mammals that fit the classical definition of eusocial (although Sherman argues many mammals that cooperatively care for their young, such as lions, may fit a broader definition of eusociality). Similar to naked mole-rats, Damaraland mole-rats live in colonies of up to 40 individuals dominated by a single breeding pair. In contrast, Palestine mole-rats—which are more closely related to rats and mice (the Muridea family) than to the Bathyergidae—live in parts of the Middle East where the soil is much softer and easier to dig through, and where food sources are distributed more evenly. This environment creates little incentive for Palestine mole-rats to work together. The furry, sausage-like critters live in complete isolation, coming together only briefly for the purpose of mating.

Scientists surmise that a harsh environment drove naked mole-rats and Damaraland mole-rats to evolve an unorthodox lifestyle. In the tropical savannas and grasslands these species inhabit, years can pass without rain. Baked by the sun, the soil becomes brick-hard and extremely difficult to dig through. Food sources, although found in large clumps, are widely and unpredictably scattered. Mole-rats appear to search for food at random, finding roots and tubers seemingly by luck. Probably because the dry soil does not carry odors very well, mole-rats can burrow right past a big tuber without knowing it. Under these circumstances, an individual mole-rat is likely to starve before it ever finds food. Working together, cooperative mole-rats can dig much faster until they find a clump of food big enough for all to share.

As a mammal with the social life of a termite and the temperature regulation of a frog, the naked mole-rat remains an enigma to scientists—and an exquisite example of how species can develop physiological and behavioral adaptations that allow them to live in the strangest of places. Scientists hope that further research on these elusive creatures will shed light not just on mole-rats' secret lives, but on the evolution of social systems in mammals more broadly.

"There's still so much to learn," says Kessler. "They are fauna incognita."

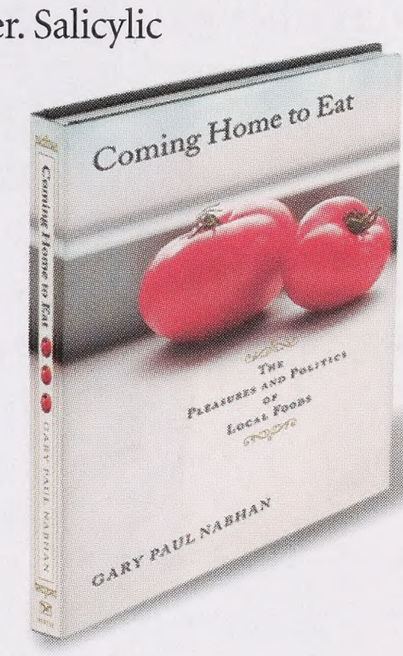
—Jill Locantore was an intern with ZooGoer.

Rodent-lovers can gawk at naked mole-rats, Damaraland mole-rats, and a Palestine mole-rat in person at the National Zoo's Small Mammal House or can spy on naked mole-rats online via the National Zoo's Mole-Rat WebCam at: http://natzoo.si.edu/Webcams/molerat1/nmcam.htm.

***Coming Home to Eat: The Pleasures and Politics of Local Foods.* Gary Paul Nabhan. 2002. W. Norton & Company, New York. 330 pp., clothbound. $24.95.**

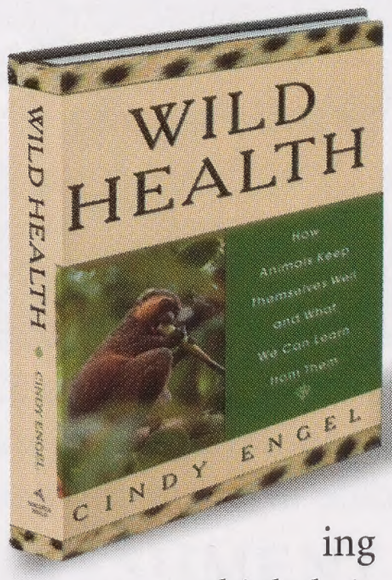
***Wild Health: How Animals Keep Themselves Well and What We Can Learn From Them.* Cindy Engel. 2002. Houghton Mifflin Company, New York. 276 pp., clothbound. $24.**

Aspirin, long used to relieve pain, has also proven to be effective in lowering the risk of heart attacks, strokes, and cancer. Salicylic acid, aspirin's active ingredient, is found naturally in many herbs, vegetables, and fruits, as well as in willows and other trees. Recently, British scientists demonstrated that organic vegetable soup has almost six times as much salicylic acid as the conventional soup, one of the first demonstrations that eating organic may have health benefits. Why should this be? Plants produce salicylic acid in response to stress and disease, so plants grown without pesticides would likely produce more, the scientists suggested.



This story illustrates and links the themes of *Coming Home to Eat* and *Wild Health*. In *Wild Health*, British writer and behaviorist Cindy Engel reviews fascinating literature of zoopharmacognosy, a new field of study that examines how wild animals medicate themselves.

Many of the substances animals are believed to ingest as medicine, and in some cases also used in traditional human medicine, are full of so-called secondary plant compounds, which plants use as defenses against pests and predators. Modern human diets lack both the amount and the diversity of such plant compounds, many of which have been largely bred out of our domesticated food plants. The upshot of this is that, for all of its abundance in the developed world, our food may actually make us sick. Witness the problems, from heart disease to adult-onset diabetes, that stem from poor modern diets.



In *Coming Home to Eat*, prize-winning ecologist and writer Gary Paul Nabhan relates that some native American groups in the Southwest have the highest incidence of diabetes in the world. These groups are apparently more susceptible to the disease, but its incidence has skyrocketed since high-fat, low-fiber processed food largely replaced their native diet of mostly fruits, vegetables, and grain. Their modern diet seems to promote the disease.

The subject of self-medication in wild animals remains controversial because the evidence is mostly circumstantial or anecdotal, but there are many purported examples. Forest elephants, colobus monkeys, mountain gorillas, chimpanzees, tapirs, macaws, parrots, and many more species, as well as many people, seek out and eat clay, which absorbs intestinal bacteria and their toxins and alleviates stomach upset and diarrhea. Kaopectate uses a type of clay as its active ingredient.

Some secondary plant compounds have antibiotic properties. South American mantled howler monkeys appear not to suffer from tooth decay. Their diet is low in sugar and includes large numbers of cashews, which are high in phenols and known to inhibit the bacteria most responsible for tooth decay.

Brown bears reportedly make a paste of osha roots and saliva, running it through their fur to repel insects or soothe bites. Native Americans are said to have learned to use this root medicinally from the bear.

Engel argues that we might learn a great deal about treating human diseases from watching animals and the diverse diet of fruits and vegetables that they utilize for their natural, protective compounds. Both are strong utilitarian arguments for the conservation of wild plants and animals.

While also interested in the health benefits of a more natural diet, Nabhan equally celebrates the sensual and spiritual pleasures of eating not only more natural foods but also locally grown ones and ones we grow (or raise) ourselves. He further maintains that growing and eating local foods is good for the land and supports conservation.

His book relates his quest to eat almost entirely from his own "food shed"—an area within a 200-mile radius of his Arizona desert home. He asked himself, "Just what exactly is it that we want to have cross our lips, to roll off our tongues, down our throats, to fill our nostrils with hardly described fragrances … and then to be lodged within our very own bodies? What do we want to be made of?" When I read his description of savoring a just-picked, lusciously juicy peach, the urge to do the same—to be made of ripe peaches—was so irresistible that I bought a peach tree.

It wasn't always easy for Nabhan to eat only from his food shed. But he found much that was wonderful. Thanksgiving's meal, for instance, comprised a smoked heritage turkey stuffed with a dressing of berries, onions, and chiltepins, accompanied by greens, all of which came from his own backyard.

Nabhan had the time and resources to find artisanal food producers, forage in the desert, grow fruits and veggies, and raise turkeys in order to 'eat locally,' and thus, in urging others to do the same, he sometimes comes across as insensitive, or at least naive. Most of us have barely enough time to stop at Safeway for bread and milk, and must often select foods based on cost as much as quality.

However, the pleasures of good food as revealed in *Coming Home to Eat*, coupled with its health benefits—which wild animals may enjoy more than we do according to *Wild Health*—will make many readers re-think their choices. Concludes Nabhan, "Whenever I have doubts about whether all this effort has been worth it, I go out to the wilds beyond my backyard and taste a fruit or flower freshly plucked from a tree or vine. My mouth, my tongue, and my heart remind me what my mind too often forgets: I love the flavor of where I live, and all the plants and creatures I live with."

And what we love we will fight to save.

—Susan Lumpkin

GOOD NEWS

More than 70 species of rare plants and animals, including tiger beetles (*Cicindela theatina*), sandhill cranes (*Grus canadensis*), and the slender spiderflower (*Cleome multicaulis*), can look forward to a rosy future in Colorado's San Luis Valley. Thanks to the purchase by The Nature Conservancy earlier this year of Baca Ranch, 151 square miles of wilderness abutting the Great Sand Dunes of southern Colorado, the area is on its way to becoming America's 56th national park. Great Sand Dunes National Park, as well as a new wildlife refuge and several additions to the Rio Grande National Forest that recent land acquisitions have made possible, will form an unfragmented landscape large enough to ensure the long-term survival of a wide variety of native plant and animal species.

Graced by 14,000-foot peaks, fertile valleys, and important watershed areas, Baca Ranch will be jointly held by The Nature Conservancy, the Department of Interior, and the Colorado State Land Board until 2005. Then, contingent upon the procurement of an additional $22 million in federal funds, the land will be transferred fully into public ownership under the management of the National Park Service and the U.S. Fish & Wildlife Service.

—*from* Environment News Service *(1/30/02)*

BAD NEWS

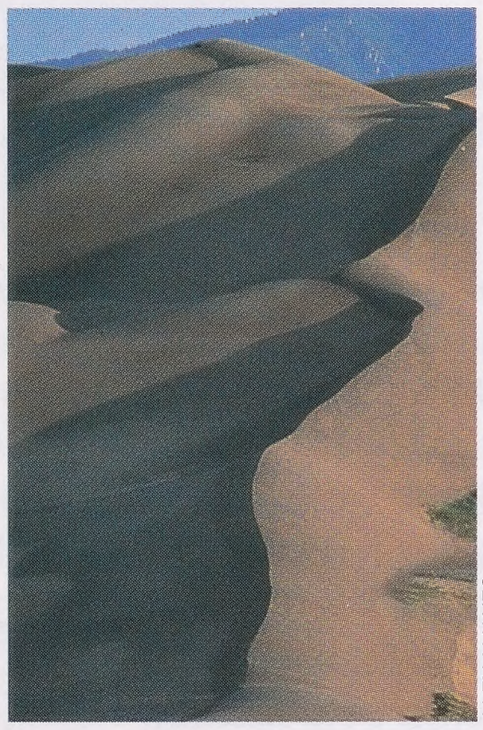
Humans aren't the only animals affected by economic downturns—endangered and threatened species are feeling the pinch, too. In January, the Kenya Wildlife Service (KWS) announced that it has gone broke and thus is unable to pay the thousands of rangers who protect the country's parks. KWS depends heavily on donor funds and income from tourism, sources that have dried up since the September 11th terrorist attacks, according to KWS acting director Joseph Kioko. Now reliant on handouts from a cash-strapped government, KWS is ill-equipped to deal with poaching, especially of elephants (*Loxodonta africana*), which appears to be on the rise.

Across the Indian Ocean, thousands of rare Australian species face a similar pecuniary predicament. Their homes—ten sanctuaries totaling 22 million acres—are part of a controversial experiment in conservation-cum-capitalism that now seems doomed to failure. Promising investors rosy profits from ecotourism, Earth Sanctuaries, Ltd., funded the nature preserves by selling shares on the Australian Stock Exchange. Although the company says it has helped pull several species off the endangered list, including the numbat (*Myrmecobius fasciatus*), platypus (*Ornithorhynchus anatinus*), and southern hairy-nosed wombat (*Lasiorhinus latifrons*), ecotourism has proven less lucrative than hoped, and stock prices have plummeted. Earth Sanctuaries, which is now $5 million short of what it needs to ensure its own financial survival, announced in January that it will begin selling off its assets. The outlook for the wildlife in its sanctuaries is positively bearish.

—*from* Environment News Service *(1/17/02) and* Environmental News Network *(1/22/02)*

THROUGH THE EYES OF A PREDATOR

Marine biologists studying creatures in the frigid depths off Antarctica have enlisted the help of some rather unorthodox research assistants—Weddell seals (*Leptonychotes weddellii*). By attaching cameras to the seals' furry heads, a team of scientists led by Lee Fuiman of the University of Texas at Austin was able to spy on the activities of Antarctic toothfish (*Dissostichus mawsoni*) and silverfish (*Pleuragramma antarcticum*), two little-known species found at depths of up to 1,300 feet. Adapted to an environment too harsh for most fish, these species are an important food source for birds and seals and are prized by commercial fishing fleets. 'Seal-cams' allow researchers to observe these elusive creatures in their natural environment. The team's findings, reported in the March 2002 issue of *Marine Biology*, shed new light on the behavior of the fish, including their use of ambient-light cues to migrate from deeper to shallower waters. The researchers believe animal-cams are an important research tool that could be used to study other deep-sea denizens.


ALEX HAWES

—*from* Environment News Service *(1/17/02)*

WHAT'S IN A NAME?

Springtime sings with the chirping of birds, and magpies (*Pica pica*) are among the loudest. So noisy and mischievous are magpies that Noah is said to have kicked them out of the Ark, relegating them to the ship's roof. Magpies, which have a wide vocal range, often imitate other birds' calls and can even be trained to mimic human words. Some claim that these striking black-and-white birds call out "mag, mag, mag" or "pie, pie, pie." But their name really parrots the birds' ostentatious personalities. "Mag" derives from Margaret, a name often used in proverbs about people who talk too much. "Pie" comes from the Latin word for magpie, *pica*, and is likely a variant of *picus*, the word for woodpecker. *Picus*, in turn, is derived from *pingere*—to paint—and probably refers to the colorful plumage of these birds.

One purpose of magpies' noisy calls is to protect their young from predation. Low-level calls serve to warn that a predator is near, while more intense calls recruit other magpies to mob a predator and drive it away from nests. A group of magpies is known as a parliament, due to their habit of forming large assemblies during which one bird will appear to orate at length.

—*Jill Locantore*

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